851B
SPECTRUM ANALYZER
DISPLAY SECTION

OPERATING AND SERVICE MANUAL

HEWLETT hp PACKARD

526

HP 851B

OPERATING AND SERVICE MANUAL

MODEL 851B

SPECTRUM ANALYZER
DISPLAY SECTION

SERIALS PREFIXED: 526 -

S. No 526- 01388

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Printed: JUNE 1965

MANUAL CHANGES

MODEL 851B

SPECTRUM ANALYZER - DISPLAY SECTION

Manual Serial Prefixed: 526-
Manual Printed: June 65

MAKE ALL CORRECTIONS IN THIS MANUAL ACCORDING TO ERRATA BELOW, THEN CHECK THE FOLLOWING TABLE FOR YOUR INSTRUMENT SERIAL PREFIX (3 DIGITS) OR SERIAL NUMBER (8 DIGITS) AND MAKE ANY LISTED CHANGE(S) IN THE MANUAL.

► NEW ITEM.

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
526-00101 & above	Errata 1
526-00126 & above	Errata 1, Change 1
526-00226 & above	Errata 1, Change 1, 2
►526-00536 & above	Errata 1, Change 1, 2, 3

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
► 526-00678 & above	Errata 1, Change 1, 2, 3, 4

ERRATA 1 Page 1-0, Table 1-1:

Change Vertical Display to read:

Vertical Display (7 cm full scale deflection):

Mode	Scale Factor	Accuracy
LINEAR	Relative Voltage/cm	±3% full scale
SQUARE	Relative Power/cm	±5% full scale*
LOGARITHMIC	10 db/cm calibrated over 0 to 60 db on CRT display	<±0.1 db/db but not more than ±2 db over full calibrated 60 db CRT display range*

*Except pulse spectra on 1MC IF bandwidth

Change Power to read: 115 or 230 volts ±10%, 50 to 400 cps, less than 55 watts.

Add:

External Sweep:

Input: 0 to +15 volt external signal (from 10K ohm source impedance) results in full 10 cm CRT horizontal trace. BNC female connector on rear panel, direct-coupled.

Blanking: -5 volt external blanking signal required to blank retrace. BNC female connector on rear panel.

Output Signals: Vertical and horizontal signals applied to CRT are available for external applications. Rear panel BNC female connectors. IF TEST POINT (20 Mc) also provided; rear panel BNC female connector.

Vertical: 0 to approximately -4 volts, open circuit; 4700 ohms source impedance.

Horizontal: 10 volts p-p ±0.3 volt, open circuit; sweep approximately symmetrical about 0 volts. Source impedance 4700 ohms.

Page 3-3, Figure 3-2, changes:

7. change "negative 5- to 10-volt pulse," to "negative 4- to 10-volt pulse,"

10. change first three lines:
J10: signal to CRT, sampled at output of video detector following 20MC IF Amplifier, and just ahead of Vertical Amplifier;

12. change to read:
J8: sweep voltage, sampled just ahead of Horizontal Amplifier; 10 volts ±0.3V peak-to-peak open circuit, 4700 ohms impedance; BNC female.
Note: VERT and HORIZ outputs will drive high-impedance X-Y recorder to obtain an X-Y plot of spectrum displayed on CRT.

ERRATA 1 (Cont'd)

► Page 5-6, Table 5-7, Logarithmic, change to read:
Logarithmic: < ±0.1 dB dB but not more than ±2 dB over full calibrated 60 dB CRT display range (except pulse spectra on 1MC IF bandwidth).
Steps e, f, g, and h: delete adjustment of signal level.

► Page 5-7, Table 5-7, 2. I. F. BANDWIDTH ACCURACY, Step a. change to read:
a. Set VERT Display to LIN. Find 2-Gc BWO signal; see Paragraphs 5-92 through 5-95.

► Page 5-8, Table 5-7, 3. I. F. SENSITIVITY, Step d, add:
VERT DISPLAY . . . . . LIN

► Page 5-11, Paragraph 5-19. LOG.
Change specification to : ±0.1 dB dB but not more than +2 dB over full calibrated 60 dB CRT display range.
Change Step e to read: Step I. F. GAIN through the rest of its positions without readjusting signal level. Limits are given in Table 5-8.

► Page 5-11, Paragraph 5-22, change Step a to read:
a. Connect Attenuator 355D between 851 and 8551, set VERT DISPLAY to LIN, and find . . . 5-100.

► Page 5-12, Paragraph 5-26, Step b, add:
VERT DISPLAY . . . . . LIN

Page 5-18, VERTICAL DISPLAY:
7th line, change A11R13 to A11R14
9th line, change A11R14 to A11R13

► Page 5-28, Paragraph 5-94. Substitute following procedure for that given in the Manual:

5-94. 10KC, 3KC, and 1KC ALIGNMENT CHECKS.

5-95. Signals for the three narrower bandwidth filters (10, 3, and 1 kc) pass through two double-tuned crystal filters. The four tuning coils are tapped; change of bandwidth is obtained by using different taps. The same filters are used for all three bandwidths; accurate adjustment of the 10-kc bandwidth should bring the 3-kc and 1-kc bandwidths within specifications. After adjustment of the 10-kc bandwidth, bandwidth is verified at the 3-kc and 1-kc settings.

5-96. IF bandwidth alignment is not a simple technique. While tuning for correct IF bandwidth, remember:

a. Ideally, all adjustments should be made simultaneously. Since this is impossible, it will be necessary to repeat the adjustments more than once to obtain the best tuning of the four filters.

b. Final adjustment should be the compromise which obtains the best characteristics for all four filters. Do not attempt to adjust the filters unless one or more are out of specifications.

5-97. EQUIPMENT REQUIRED.

Ref No.	Equipment Required	No.
10*	VHF Attenuator (355D)	1
D**	Coax Term. w/BNC males (10503A)	2
G**	GC plastic tuning wand	1
K**	Screw-holding screwdriver	1

*Table 5-1 **Table 5-2

5-98. SIGNAL SOURCE CALIBRATION.

5-99. To check the bandpass characteristics of the narrower IF filters the 851 sweep width must be narrow enough that the IF bandwidth can be determined accurately at the half-power points. This may be done by applying a signal to the 20MC IF which is swept in synchronism with the 851 sweep. Such a signal can be derived from the second harmonic of the 8551's 10MC Reference Oscillator.

ERRATA 1 (cont'd)

5-99A. When the 8551 is stabilized, the BWO is phase-locked to a 10MC Reference Oscillator. For a BWO frequency of 4 Gc and a spectrum width of 1 Mc/cm the Reference Oscillator would be swept 2.5 kc/cm (BWO locked to the 400th harmonic of 10 Mc; 1 Mc/cm divided by 400 is 2.5 kc/cm). [NOTE: For a 4-Gc BWO frequency, FREQUENCY(GC) must be at .01-2 or 1.8-4.2; (at these settings n = 1).] If the output of the Reference Oscillator is connected to a narrow-band IF filter tuned to 20 Mc, the IF will pass only the second harmonic of the 10MC Reference Oscillator. This is 20 Mc swept at 5 kc/cm. Other values of sweep width may similarly be derived:

Spectrum Width	20MC Sweep Width (851 Display)
1 Mc/cm	5 kc/cm
300 kc/cm	1.5 kc/cm
100 kc/cm	500 cycles/cm
30 kc/cm	150 cycles/cm

5-100. MEASUREMENT SETUP.

5-101. Use the 8551 10MC Reference Oscillator as the signal source for the narrower IF bandwidth alignment procedures. See Figure 5-8A for test setup and Paragraph 5-97 for recommended equipment.

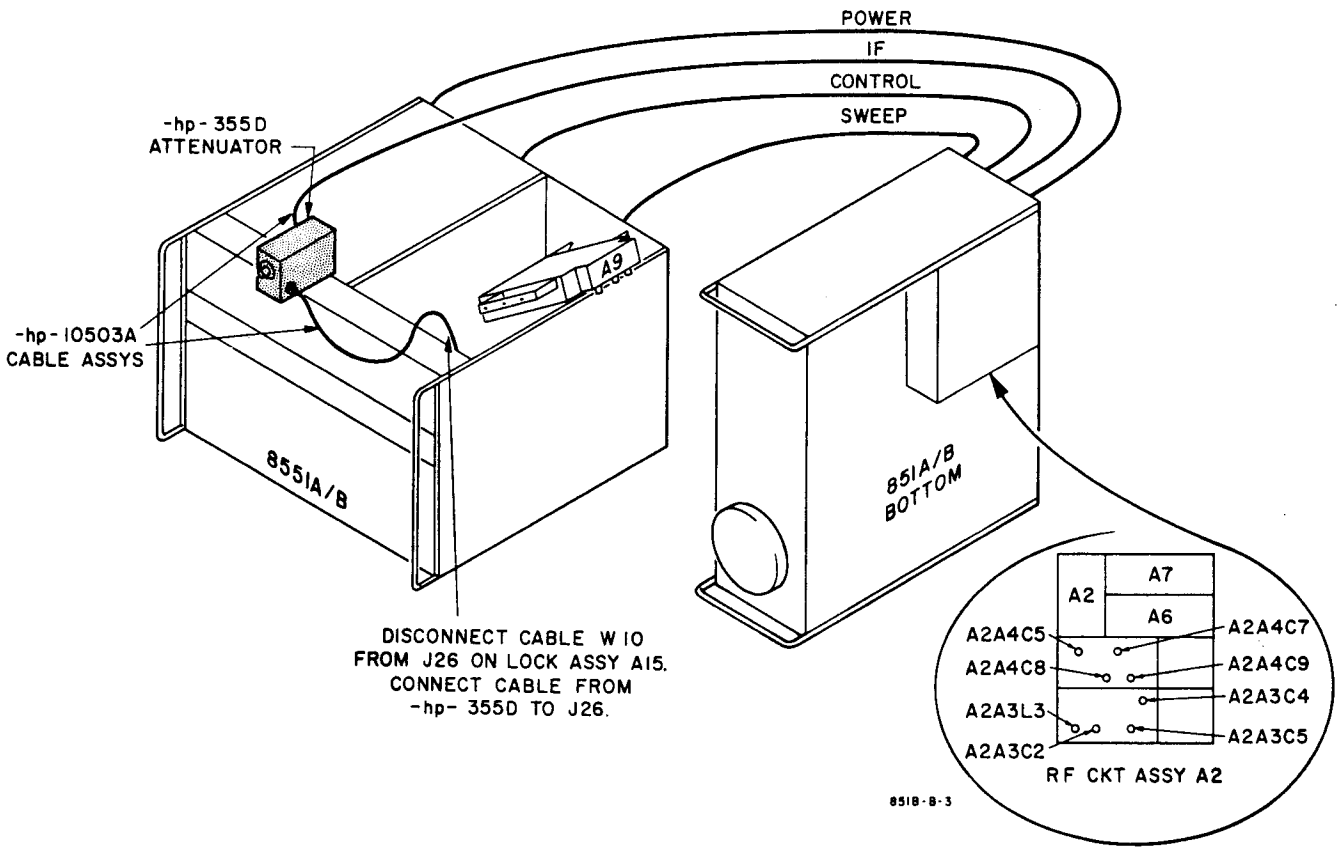

Figure 5-8A. Measurement Setup, 10KC IF Bandwidth Alignment and Checks

ERRATA 1 (Cont' d)

5-102. 10 KC PROCEDURE, INITIAL SETUP.

a. Set the 355D to 40 dB.

b. Make the following settings:

8551

LINE . . . . . STANDBY*
SPECTRUM WIDTH . . . . . 1 MC/CM
SPECTRUM WIDTH VERNIER . . . . . CAL
FREQUENCY (GC) 01-2
TUNE . . . . . 4 Gc on LOCAL OSC FREQ (F_{LO} scale)

*Note: LINE remains in STANDBY throughout the procedure.

8551A only

FREQUENCY TUNING . . . . . STABILIZE**

8551B only

TUNING SELECTOR . . . . . STABILIZED NORMAL**
STABILIZATION . . . . . STABILIZED**

**Note: Control setting only; do not perform stabilization procedure.

851

BASE LINE CLIPPER . . . . . max ccw
SYNC. . . . . INT
I. F. BANDWIDTH . . . . . 10 KC
VERT DISPLAY . . . . . LIN
SWEEP TIME . . . . . 3 MILLISEC/CM
SWEEP TIME VERNIER . . . . . CAL
INTENSITY . . . . . about 3 o' clock
IF GAIN . . . . . .30 + 0
IF VERNIER . . . . . ccw

c. Check alignment of the base-line trace with the horizontal axis. If necessary, adjust VERT POS and TRACE ALIGN to bring base-line trace exactly parallel with and on the graticule base line.

5-103. 10 KC ALIGNMENT PROCEDURE.

a. Adjust 8551 TUNE to center the display on the 851. Adjust IF GAIN VERNIER for a maximum vertical deflection of exactly 7.0 cm.

b. Bandwidth tuning adjustments are inside the RF Circuit Assembly casting (see Figure 5-22); location of adjustments is marked on the cover. Access holes, covered with removable plug-in buttons, are provided in the casting cover. Unless Balance Adj capacitor A2A3C5 or A2A4C8 has been replaced, do not remove the casting cover.

Note

It is not likely that capacitor A2A3C5 or A2A4C8 will require replacement. However, if either has to be replaced, before removing it, note degree of mesh between stator and rotor. When installing replacement capacitor, set it to approximately the mesh of original capacitor. After installing and presetting replacement capacitor, fasten cover to casting with five or six of the 26 screws which hold the casting cover in place.

Perform the rest of the 10KC alignment procedure with the cover in place on the casting.

c. Adjust 1-10KC Bandwidth Adj capacitors A2A3C4, A2A3C2, A2A4C5, and A2A4C9 for maximum bandwidth.

Note

In tuning capacitor A2A3C4, A2A3C2, or A2A4C5 through its tuning range it will be found there are two points which give vertical deflection peaks. Since there is little difference between the amplitude of the two peaks, it is difficult to distinguish which is the correct tuning region. If correct IF bandwidth tuning cannot be obtained on one peak, try the the other. Correct IF bandwidth tuning can only be obtained

ERRATA 1 (Cont' d)

when the adjustment of each capacitor is made in its true tuning region. Maximum bandwidth is usually obtained by tuning off the peak slightly.

d. Adjust Imped Adj A2A3L3 and Frequency Adj A2A4C7 for maximum vertical deflection.

e. Center display with TUNE and set maximum vertical deflection to exactly 7.0 cm with IF GAIN. See Figure 5-8B. Display should be 2 cm wide at 5 cm amplitude (half-power points) (sweep width of 851 display is 5 kc/cm). If not within ±20% of the correct bandwidth (1.6 to 2.4 cm at 5 cm amplitude) repeat steps c through e until the correct bandwidth is obtained.

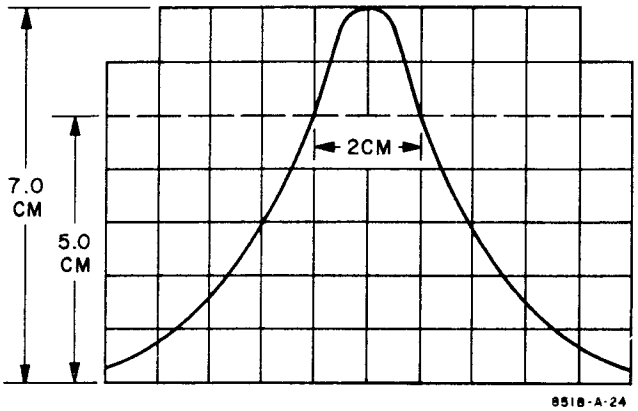

Figure 5-8B. Optimum Bandpass Characteristics, IF Bandwidth Adjustments

5-104. 3KC AND 1KC BANDWIDTH CHECK PROCEDURE.

a. Set IF BANDWIDTH to 3KC and SPECTRUM WIDTH to 300KC/CM (which gives 851 display sweep width of 1.5 kc/cm).

b. Adjust IF GAIN and IF VERNIER for maximum vertical deflection of exactly 7.0 cm.

c. Width of display at 5.0 cm axis should be between 1.6 and 2.4 cm. See Figure 5-8B.

d. Set IF BANDWIDTH to 1KC and SPECTRUM WIDTH to 100 KC/CM (which gives 851 display sweep width of 500 cycles/cm).

e. Adjust IF GAIN and IF VERNIER for vertical deflection of exactly 7.0 cm.

f. Width of display at 5.0 cm axis should be between 1.6 and 2.4 cm. See Figure 5-8B.

Note

If 1KC bandwidth appears too wide, recheck tuning of Freq Adj A2A4C7 (Paragraph 5-103, step d).

g. If capacitor A2A3C5 or A2A4C8 was replaced, and casting cover is only partly secured, fasten in place with all 26 screws. For final adjustment (Paragraph 5-105), the cover must be tightly fastened to the casting.

Note

A screw-holding screwdriver is recommended for turning the screws.

5-105. FINAL 1 - 10KC BANDWIDTH ADJUSTMENT.

5-106. Set IF BANDWIDTH to 10KC and SPECTRUM WIDTH to 1 MC/CM. Recheck bandwidths (Paragraphs 5-103, 5-104), making adjustment if necessary, until all bandwidths are within specifications.

Note

Cover must be fastened down tightly during final adjustment.

ERRATA 1 (Cont'd)

Page 5-31, Paragraph 5-119b, change A11R13 to A11R14
Paragraph 5-119c, change A11R14 to A11R13

Page 5-36, Table 5-23A:
Change Short Ckt Current for Triplett 630 from
"32 ma" to "3.25 ma" for R x 100 range
"3.25 ma" to "325 μa: for R x 1K range

Page 5-52, Figure 5-19, change PREFIX ALL DESIGNATIONS WITH A1 to PREFIX ALL DESIGNATIONS WITH A12.

Page 5-55, Figure 5-24:
In lower middle, add asterisk to A2A4R4.

Page 5-56, Figure 5-25, change
R13 designation from 40DB LOG CALIB to 60DB LOG CALIB
R14 designation from 60DB LOG CALIB to 40DB LOG CALIB

Page 5-57, Figure 5-27, VERT DISPLAY Switch:
Upper left corner of schematic, change A11C1 from 220 to 300.
Change R13 designation from 40DB to 60DB and R14 designation from 60DB to 40DB.
Add A11CR5 from cable W1, with cathode to ground.
Lower right corner, change A2C2 from 33 to 3.3 pf.

Page 5-59, Figure 5-29:
Upper right corner, add asterisk to 1000-ohm R19.
Add to Notes: * = Factory selected; average value shown.

Page 5-61, Figure 5-33:
Lower left corner, add asterisk to A6R35, and change value to 39K.
Lower right corner, add asterisk to R59.
Upper right corner, change A6R66 from 33K to 68K.
Lower middle, change A6R43 to 470.
Add to NOTES: * = factory-selected value; part may be omitted.

Table 6-1, change to read:

A6R43	0683-4715	R:fxd comp 470 ohm 5% 1/4W (Note: A6R43 is 1000 ohms in instruments with serials below 526-00201: however, 470 ohms is the proper replacement for all instruments.)
A6R66	0684-6831	R:fxd 68K 1/4W
A11C1	0140-0225	C:fxd 300 pf 1% 300 vdcw
A11CR5	1901-0033	Diode
V1	5083-9010	Electron tube: cathode ray, P2 phosphor
V1	5083-9011	Electron tube: cathode ray, P7 phosphor
V1	5083-9012	Electron tube: cathode ray, P31 phosphor

CHANGE 1
526-00126
& above

Page 5-59, Figure 5-29, Vertical Amplifier Schematic:
Lower left corner, change A7C2 from 0.47 μf to 2.2 μf.

Table 6-1, change to read:

A7C2	0180-0155	C:fxd 2.2 μf.

CHANGE 2
526-00226
& above

Page 5-59, Figure 5-29, Vertical Amplifier Schematic:
Lower left corner, add A7R26, 1000 ohms, in series with A7R5.

Table 6-1, add:

A7R26	0687-1021	R:fxd 1000 ohm 1/2W.

► CHANGE 3
526-00536
& above

Page 5-63, Figure 5-35, HV Power Supply Schematic:
Upper left, place asterisk on A8R1.
Add Note: * = Factory-selected value; average value shown

► CHANGE 4
526-00678
& above

Page 5-55, Figure 5-24, IF Bandwidth Switching Circuits:
Upper left, change A2A2R2 from 1500 to 1200 ohms.

Page 5-57, Figure 5-26, VERT DISPLAY Switch, etc. Schematic:
Lower center, change A2A7R4 from 51 to 100 ohms.

Table 6-2, change to read:
A2R2 0683-1225 R:fxd comp 1200 ohm 5% 1/4W
A7R4 0683-1015 R:fxd comp 100 ohm 5% 1/4W

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Table 1-1. Specifications, 851B Display Section

DISPLAY CHARACTERISTICS

Vertical Display:
Linear, square (power), or logarithmic
Dynamic Range: Linear, 70:1; square, 70:1; log, 60 db
Accuracy: Linear, ±3% of full scale; square, ±5% of full scale*; log, ±2 db*.

I. F. Bandwidth:
Manual: Bandwidths of 1, 3, 10, 100 Kc, and 1 Mc can be selected.
Auto Select: One of the above bandwidths automatically selected for best resolution of a CW signal with each combination of spectrum width and sweep rate.
Bandwidth Accuracy: Individual bandwidths are calibrated within ±20%; bandwidth repeatability and stability typically better than ±3%.

I. F. Input:
Center Frequency: 20 Mc
Input Impedance: 50 ohms, nominal
Input Required for 6-cm Vertical Display:
1-Mc bandwidth, -62 to -53 dbm
100-Kc bandwidth, -75 to -60 dbm
10-Kc bandwidth, -95 to -80 dbm
3-Kc bandwidth, -95 to -80 dbm
1-Kc bandwidth, -86 to -71 dbm

Maximum CW Input Signal: -14 dbm

I. F. GAIN Set: Two-section attenuator provides 0 to 80 db attenuation in 1-db steps. One section provides 0 to 70 db attenuation in 10-db steps; the other, 0 to 10 db in 1-db steps. Vernier provides continuous adjustment between 1-db steps.

I. F. GAIN Set Accuracy: 70-db section, ±0.5 db; 10-db section, ±0.1 db

Sweep Rate: Six calibrated rates from 3 msec/cm to 1 sec/cm in a 1, 3, 10 sequence. Vernier provides continuous adjustment between calibrated rates and extends slowest rate to at least 3 sec/cm.

Sweep Rate Accuracy: ±3%

Sweep Synchronization:
Internal: Sweep free runs
Line: Sweep synchronized with power-line frequency
External: Sweep synchronized with externally applied signal +3 to +15 volts peak
Single Sweep: Sweep actuated by panel pushbutton

* Except pulse spectrums on 1-Mc I. F. bandwidth

GENERAL

Output Signals: Vertical and horizontal signals applied to CRT are available for external monitoring.
Vertical: 0 to -4 volts; output impedance, 4700Ω
Horizontal: 10 volts peak-to-peak, ±0.3 volt open circuit; sweep approximately symmetrical about zero; output impedance, 4700Ω

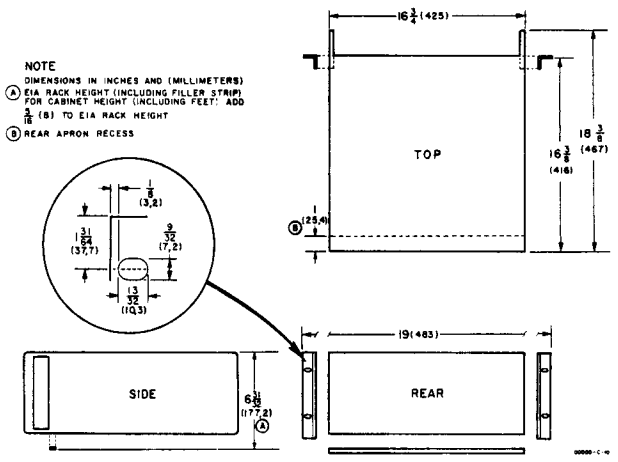
Cathode-Ray Tube: 7.5-kv post-accelerator tube with P2 medium-persistence phosphor and internal graticule. Light blue filter supplied. Other phosphors optional.

Internal Graticule: Parallax-free 7 x 10 cm, marked in cm squares with 2-mm subdivisions on major vertical and horizontal axes.

RFI: Conducted and radiated leakage limits are below those specified in MIL-I-6181D and MIL-I-16910.

Power: 115 or 230 volts ±10%, 50 to 1000 cps, approximately 25 watts

Dimensions:



Weight: Net 34 lb (15 kg); shipping 45 lb (20, 3 kg)

Accessories Furnished: 7-1/2 foot (2290 mm) power cable; rack mounting kit; joining-bracket kit for bonding Model 851 to Model 8551

Options:
07. P7 phosphor in lieu of P2 (amber filter supplied), no additional charge.
31. P31 phosphor in lieu of P2 (green filter supplied), no additional charge.

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. The Model 851B is the Display Section of the Hewlett-Packard Spectrum Analyzer; the RF Section is the Model 8551. Together, the 851/8551 provide an Analyzer which can display up to 2 Gc of spectrum. Analyzer input range is from 10 Mc to 42 Gc, its dynamic range is 60 db, its sensitivity is at least -65 dbm, its image separation is 4 Gc, and its functions are calibrated. The RF Section, which is a receiver that electronically scans the input signal, is described in a separate Operating and Service Manual.

1-3. DESCRIPTION.

1-4. The 851B Display Section is an oscilloscope with an unusually wide dynamic range. The display is amplitude vs frequency, and range is such that a fundamental and harmonics down as far as 60 db can be viewed simultaneously. In addition to the features offered by other good oscilloscopes -- features such as calibrated sweep times, calibrated gain, choice of synchronizing voltages, vertical and horizontal positioning, focus adjustments, and intensity variation -- the 851B provides additional facilities which widen the scope of the Analyzer as an electronic tool.

a. Choice of Amplitude Calibrations. The 851B display can be made 1) proportional to voltage (linear), proportional to power (square), or 3) proportional to the log of the input voltage. Use of logarithmic calibration is what makes it possible to view amplitude variations as great as 60 db in the same display.

b. Choice of Calibrated I. F. Bandwidths. The 851B provides five calibrated I. F. bandwidths: 1 Mc, 100 Kc, 10 Kc, 3 Kc, and 1 Kc. The narrower bandwidths provide greater resolution and the wider bandwidths viewing of a broader band of frequencies.

c. Automatic Selection of Optimum I. F. Bandwidth. Characteristics of the display are a function of the width of frequency band swept (determined by the setting of the SPECTRUM WIDTH switch in the 8551 RF Section), the I. F. bandwidth, and the sweep speed. For automatic selection of optimum bandwidth for selected sweep speeds and width of band swept, the 851B provides an AUTO SELECT position on the I. F. BANDWIDTH switch.

d. Facilities for Making Superior Oscillograms. The 851B CRT has an internal graticule, thus providing a parallax-free presentation. In addition, when the internal graticule is illuminated by ultra-violet light, resulting photographs are of unusually fine quality. (The hp 196B Oscilloscope Camera includes a source of ultra-violet light.) Another feature of the Display Section is base-line blanking capability. This feature is useful both when viewing low-level signals or when making an oscillogram since features of interest are clearer when base line glow is blanked. For photographic convenience, the CRT includes a bezel for mounting a camera, and a SINGLE SWEEP lamp which indicates completion of the sweep.

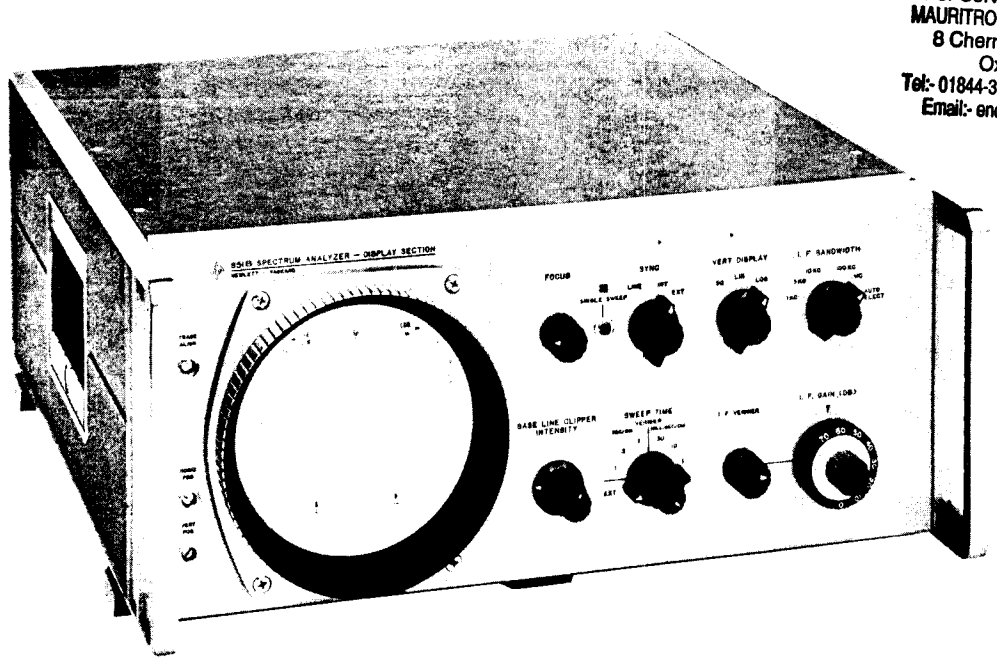


Figure 1-1. Model 851B Spectrum Analyzer - Display Section

1-5. APPLICATIONS.

1-6. Some of the many applications of the Hewlett-Packard Spectrum Analyzer are discussed in Application Notes 63 and 63A. One of these applications is analyzing short RF pulses. Because of features contributed by the 851B -- a choice of I. F. bandwidths, dynamic range of at least 60 db, and calibrated sweep speeds, the Analyzer is a valuable tool in pulse work. Short RF pulses (tens of nanoseconds) have previously been difficult to analyze in the frequency domain because of limitations in dynamic range and the I. F. bandwidth of available analyzers. The 1-Mc I. F. bandwidth of the 851 gives 11 db of additional dynamic range when measuring short pulses, additional by comparison to a hypothetical system having 80-Kc I. F. bandwidth and equal CW dynamic range. With the 851B calibrated sweep times, pulse repetition rate can be determined directly from the display, obviating the need for measuring repetition rate externally.

1-7. CATHODE-RAY TUBE WARRANTY.

1-8. The cathode-ray tube (CRT) supplied with the 851B is guaranteed against electrical failure by Hewlett-Packard for one year from the date of sale. Warranty claim and adjustment procedures for the CRT are given on the warranty at the rear of this manual. Use this form and follow claim instructions exactly when returning a CRT for warranty adjustment.

Table 1-2. Accessories Supplied

Part Number	Name	Description
8120-0078	Power cable	Standard 3-conductor 7-1/2 foot NEMA power cable
5060-0216	Joining Bracket Kit	Plates and hardware for bonding 851 to 8551
5060-0076	Rack Mounting Kit	Parts and hardware for mounting 851 in 19-inch rack

Table 1-3. Accessories Available

Model Number	Name	Description
8442	1 KC Bandwidth Crystal Filter	For use ahead of 851B I. F. input; extremely good skirt selectivity -- pass band less than 10 Kc 60 db down

Table 1-4. Options

Number	Description
07	In lieu of P2 phosphor, P7 long-persistence phosphor and amber filter supplied; no additional charge.
31	In lieu of P2 phosphor, P31 medium-persistence phosphor and green filter supplied; no additional charge.

SECTION II
INSTALLATION

2-1. INITIAL INSPECTION.

2-2. MECHANICAL CHECK.

2-3. If damage to the shipping carton is evident, ask that carrier's agent be present when instrument is unpacked. Inspect instrument for mechanical damage such as scratches, dents, or broken knobs. Also check the cushioning material for signs of severe stress.

2-4. PERFORMANCE CHECK.

2-5. The electrical performance of the 851B should be verified as soon as possible after receipt. Performance checks suitable for incoming inspection are given in Paragraphs 5-7 through 5-34.

2-6. CLAIM FOR DAMAGE.

2-7. If the 851B is mechanically damaged or fails to meet specifications on receipt, notify the carrier and the nearest Hewlett-Packard office immediately. (A list of sales and service offices is at the back of this manual.) Retain the shipping carton and the padding material for the carrier's inspection. The field office will arrange for the repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

2-8. CONNECTIONS.

2-9. Connect the two Sections of the Analyzer:

a. Place the Model 851 Display Section on the Model 8551 RF Section.

b. A power cable is supplied with the 851, and five cables are supplied with the 8551. Connect cables as shown in Figure 2-1.

c. To obtain the best common ground for the two Sections, strap the Sections together with the plates provided in the Joining Kit (supplied). Bonding instructions are supplied with the Kit.

2-10. POWER REQUIREMENTS.

2-11. The 851B is designed to operate from either a 115- or 230-volt 50- to 1000-cycle source, and requires approximately 25 watts. However, when used as the Display Section of the Analyzer the line input for the 851B is in the 8551 RF Section, and power is extended to the 851B by external cable. The two Sections of the Analyzer require approximately 300 watts and a nominally 115- or 230-volt 50- to 60-cycle source.

2-12. Both Sections are equipped with input transformers. Primary windings on each input transformer can be connected in series or in parallel; changing from one type of connection to the other is by operation of a slide switch (115/230) located on the rear panel (see Figure 3-2). Always check the setting of the slide switches in both Sections before plugging the Analyzer into a power source; the setting of the 115/230 switch must agree with the voltage of the power source. Refer to Figure 2-1 for sequence of the plug-in procedure. (Sequence for turn-on is given in Figure 3-3.)

2-13. The fuse installed at the factory is for 115-volt operation. When operating from 230 volts, use a fuse of the value shown adjacent to the 230-volt position of the slide switch.

2-14. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that instrument panel and cabinet be grounded. The Analyzer is equipped with a three-conductor power cable; the third conductor is the ground conductor, and when the cable is plugged into an appropriate receptacle, the instrument is grounded. The offset pin on the power cable three-prong connector is the ground connection. To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter, and connect the green lead on the adapter to ground.

2-15. ESTABLISHING FIGURE-OF-MERIT RATING.

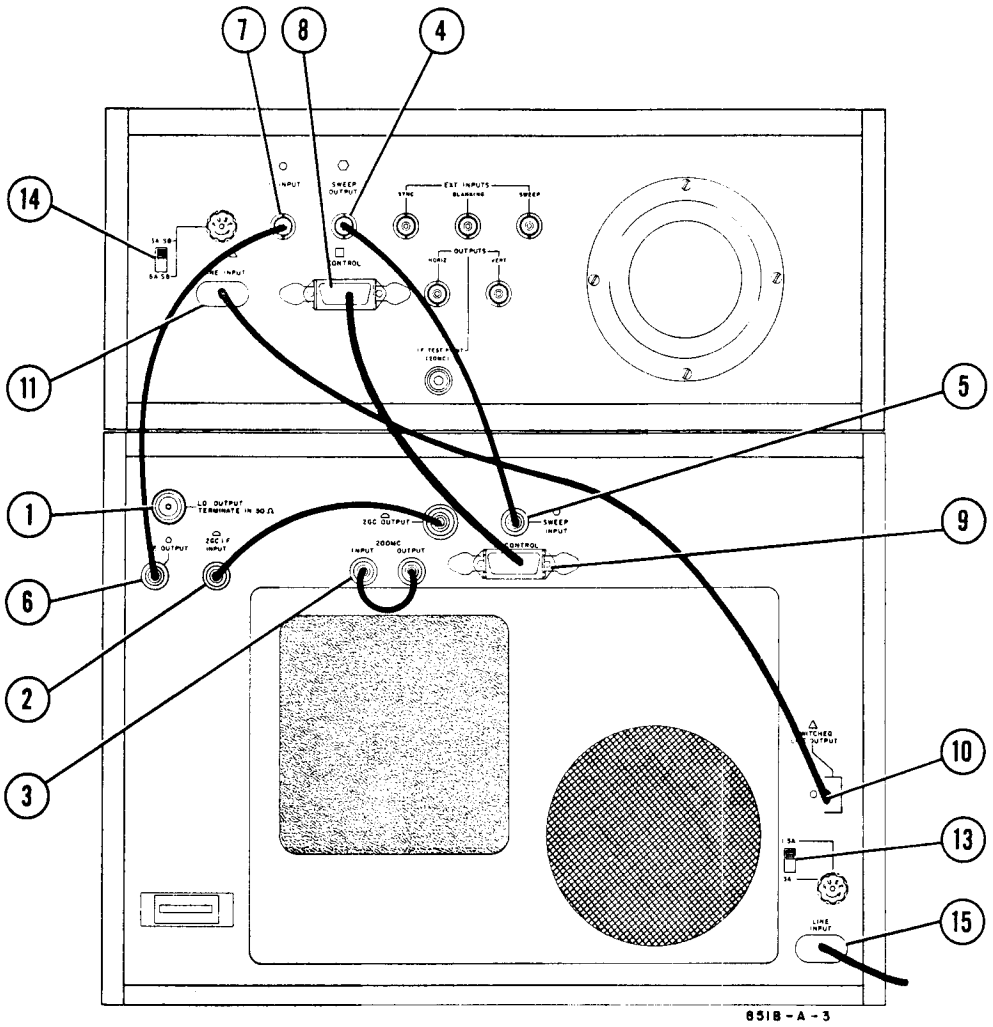
2-16. Immediately following initial inspection, it is good practice to establish a figure-of-merit rating for your 851B Display Section. Throughout the life of the components for which the checks establish a rating, the figure of merit can be used for comparison purposes to determine whether the circuits are performing at the level of excellence they had when the instrument was shipped from the factory.

2-17. A figure of merit for the 851B can be established by performing a sensitivity check. Procedure is given in Paragraph 5-24. In the table below, space is provided for recording the figures obtained.

2-18. RACK MOUNTING.

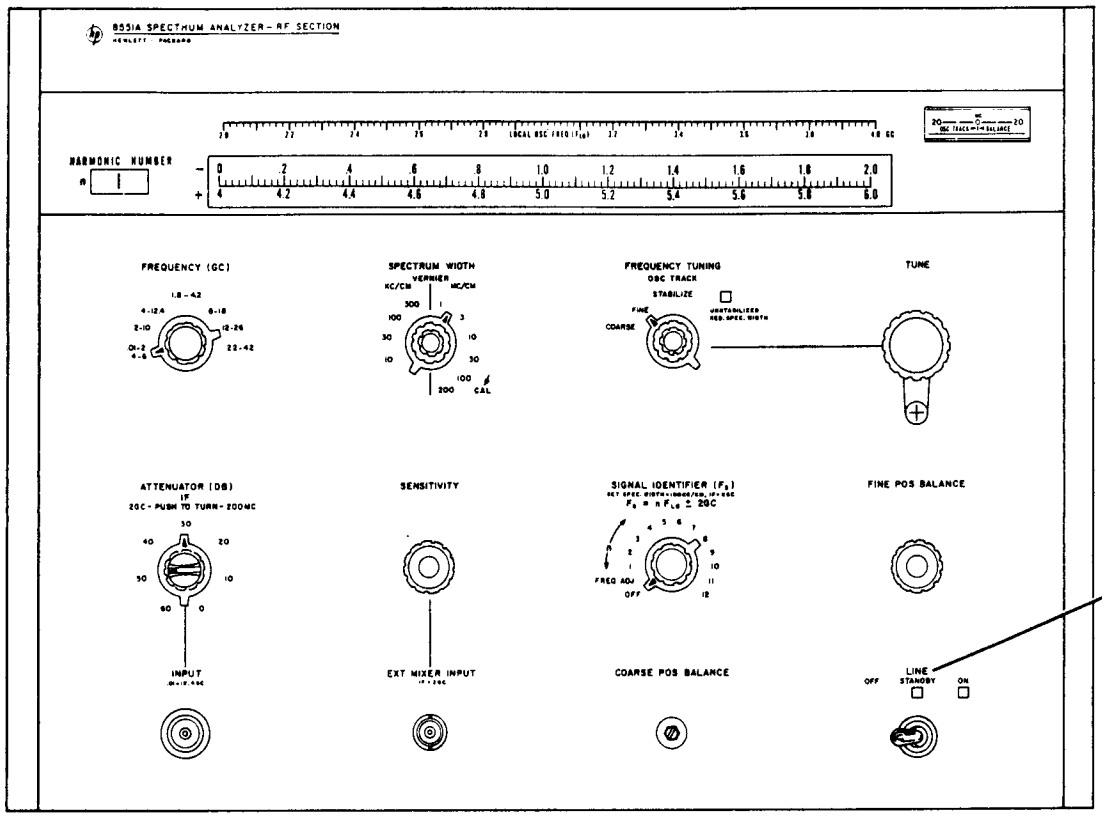
2-19. Procedure for rack-mounting the 851B is indicated in Figure 2-2.

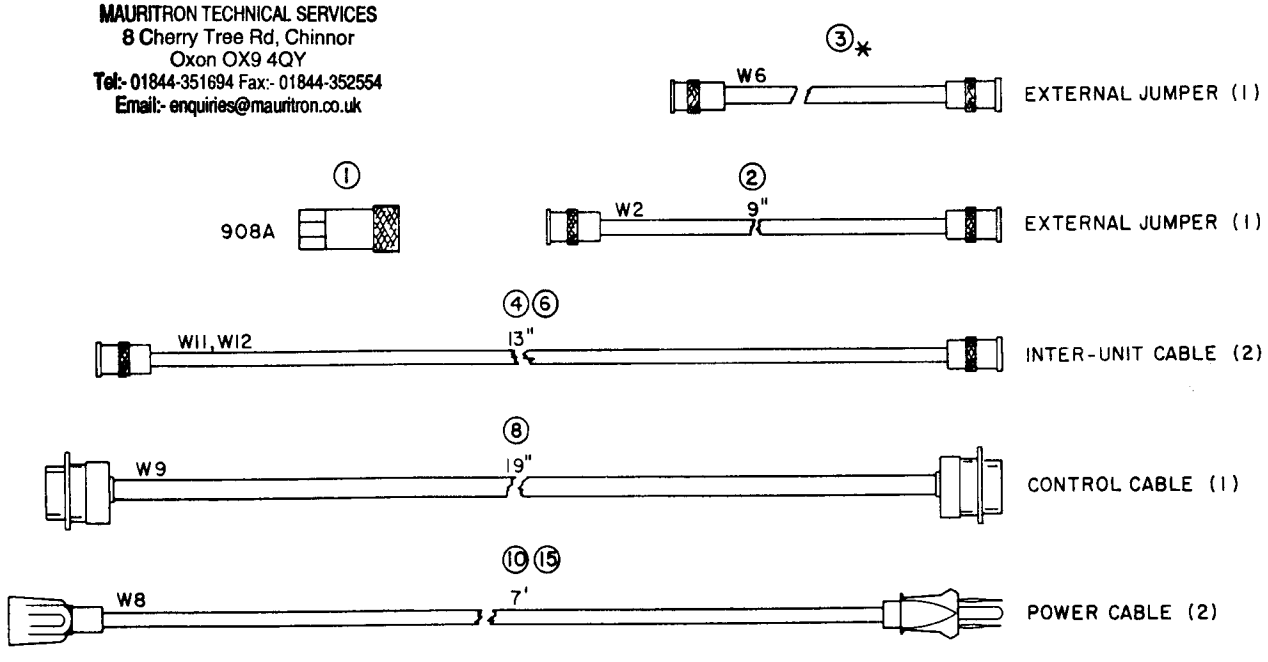
Input		Settings		Sig Gen Used	Cable Used	Power Input for 6-cm Vertical Deflection
Freq	Point	I. F. BW	I. F. GAIN (DB)			
20 Mc	I. F. INPUT	1 MC 100 KC 10 KC 3 KC 1 KC	70 + 10 I. F. VERNIER, max cw	606A	10503A	



1. Model 908A Coaxial Termination: install in LO OUTPUT - TERMINATE in 50 Ω.
2. ⌓ Connect 2GC OUTPUT to 2GC I. F. INPUT.
3. Connect 200MC INPUT to OUTPUT.
4, 5. ⬡ Connect SWEEP OUTPUT to SWEEP INPUT.
6, 7. ○ Connect I. F. OUTPUT to I. F. INPUT.
8, 9. □ Connect 851 CONTROL to 8551 CONTROL.
10, 11. △ Connect SWITCHED LINE OUTPUT to LINE INPUT.
12. SET LINE to OFF.
13. 8551 line voltage switch: set for nominal voltage of power source (set with blade of screwdriver); check that fuse is value marked adjacent to selected setting.
14. 851 line voltage switch: set to same setting as set at 8551 line voltage switch; check that fuse is proper value for voltage set.
15. LINE INPUT: connect to 115/230V 50/60 cps 300-watt source.

Figure 2-1. Installation Connections, Model 851/8551 Spectrum Analyzer (sheet 1 of 2)





* LENGTH SELECTED AT FACTORY

8551A-B-1

Figure 2-1. Installation Connections, Model 851/8551 Spectrum Analyzer (sheet 2 of 2)

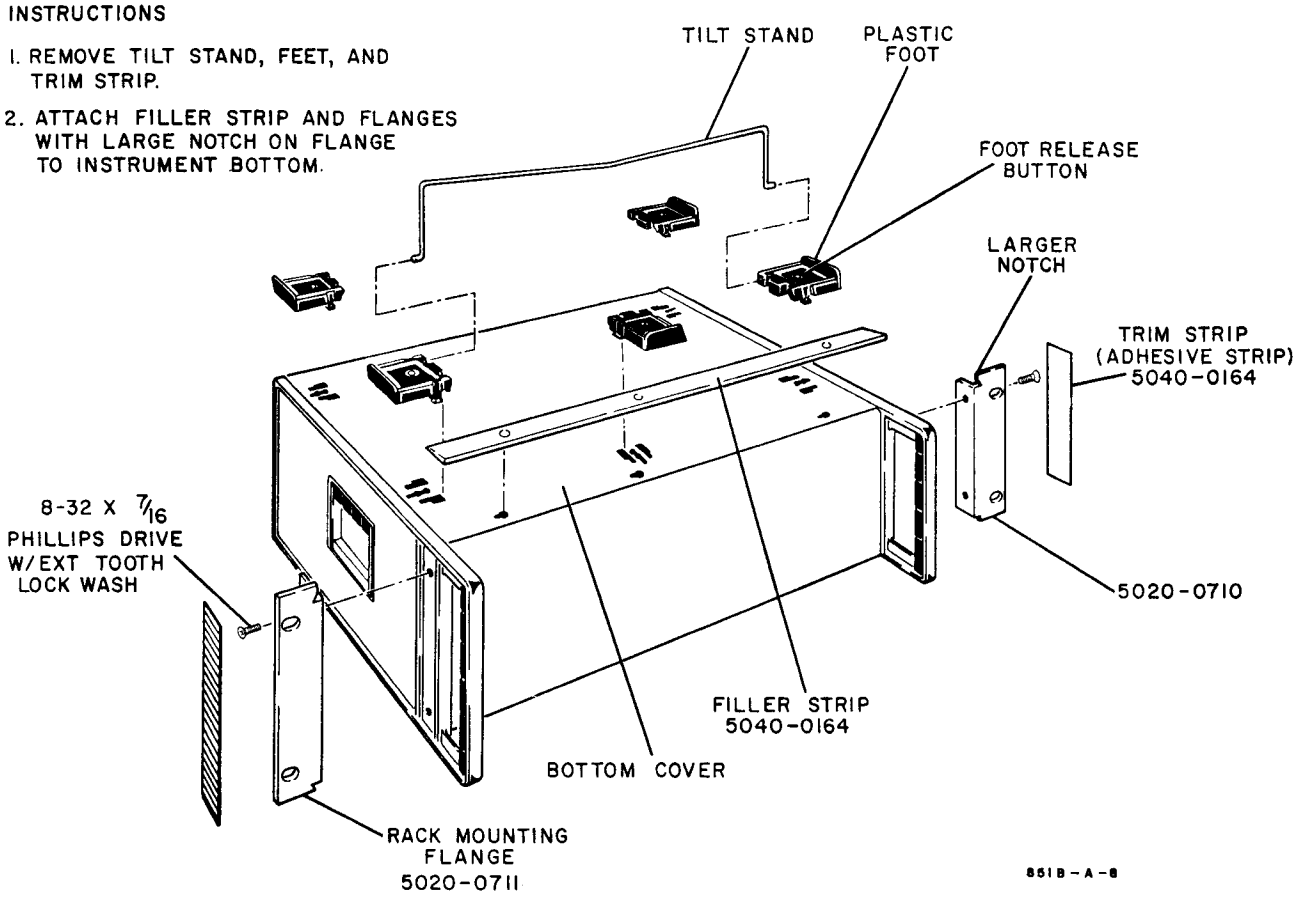


Figure 2-2. Rack-Mounting Procedure, 851B

SECTION III
OPERATION

3-1. INTRODUCTION.

3-2. The Model 851/8551 Spectrum Analyzer is a triple-conversion superheterodyne scanning receiver with a visual amplitude-vs-frequency output. Information obtained by the 8551 RF Section is displayed on the 851 CRT. Analyzer controls are calibrated and thus considerable information can be read directly from the display; calibration accuracies are given in Table 1-1.

3-3. Basic step-by-step procedures for putting the Analyzer into operation are given in this Section of the Manual. Information on spectrum analysis and applications of the 851/8551 Spectrum Analyzer are provided in hp Application Note 63.

3-4. Operating the Analyzer requires both the Display and RF sections. Instructions for the 851B will make more sense if instructions for the 8551 RF Section are included also, and so the Operating Plates, Figures 3-3 and 3-4, give instructions that include both instruments. However, always remember that instructions given in this Manual are incomplete in that they do not discuss limitations on input signal level. Before turning on the Analyzer, therefore, refer also to the operating instructions (Section III) in the Manual for the 8551.

3-5. Front panel controls are identified and briefly described in Figure 3-1, and rear panel connectors and switches are identified in Figure 3-2; initial turn-on instructions are given in Figure 3-3, and photographic procedures in Figure 3-4.

3-6. Optimum I. F. BANDWIDTH setting for selected SPECTRUM WIDTH and SWEEP TIME settings is given in Figure 3-5. As used here, optimum is defined as the narrowest bandwidth which does not attenuate the signal because of limitations in the rise time of the 20-Mc I. F. Amplifier. (The SPECTRUM WIDTH switch is on the 8551, and determines width of band swept by the 8551 Local Oscillator.)

Note

With I. F. BANDWIDTH at AUTO SELECT, optimum bandwidth is automatically selected.

3-7. DESCRIPTION.

3-8. The 851B Spectrum Analyzer Display Section includes a 20-Mc I. F. amplifier with five calibrated bandwidths, shaping circuits which provide a choice of amplitude calibration, and a cathode-ray tube and associated circuits, one of which is a calibrated SWEEP TIME switch.

3-9. I. F. BANDWIDTH.

3-10. SELECTABLE. Bandwidth of the 20-Mc I. F. Amplifier is 1 Mc. However, by means of selectable precision filters, bandwidth of the 20-Mc I. F. Amplifier can be narrowed to 100 Kc, 10 Kc, 3 Kc, or 1 Kc; selection is made with the I. F. BANDWIDTH switch.

3-11. DETERMINES RESOLUTION. Display resolution is determined by the setting of I. F. BANDWIDTH. The signal shown on the CRT can be considered as a presentation of the spectrum as seen through a moving window. How much of spectrum can be seen at any one instant is the ratio of 20 MC I. F. Amplifier bandwidth to spectrum width displayed. For example, if the I. F. BANDWIDTH switch is set at 1 Mc and the SPECTRUM WIDTH switch is set at 100 MC/CM (spectrum being examined, 1 Gc), one-thousandth of the spectrum can be seen at any instant as the horizontal sweep voltage moves the "window" across the CRT. The rate at which the "window" moves across the graticule is set by the SWEEP TIME switch; the shape of the "window" is the passband characteristic of the 20 MC I. F. Amplifier.

3-12. DISPLAY.

3-13. SHAPING. In addition to the usual oscilloscope controls and circuits, the 851B Display Section provides circuits for shaping the signal derived from the 20-Mc I. F. signal. By means of the shaping circuits, in addition to the conventional linear display (proportional to signal voltage), the display can be made proportional to signal power (square) or to the logarithm (level in db) of the signal. Signal shaping (together with the wide dynamic range of the Analyzer) makes it possible to show signals of widely-varying amplitudes on the same display; for example, signals at -30 dbm and -90 dbm can be viewed simultaneously. Choice of display ratio is made with the VERT DISPLAY switch.

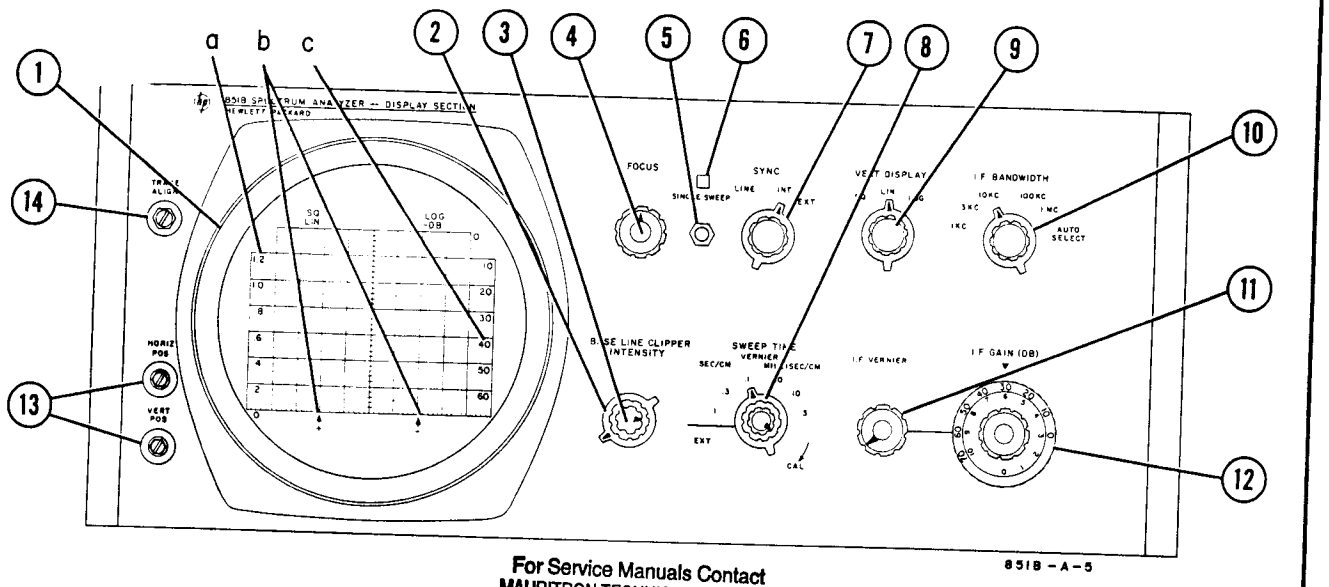
3-14. SCALES. There are two calibrations on the 851 CRT graticule. One is numerical (0.2/cm), the other is logarithmic (10 db/cm). With VERT DISPLAY at LIN or SQ, use the numerical calibration; at LOG, use the DB scale.

3-15. OSCILLOSCOPE.

3-16. TUBE. The CRT used in the 851 is a 5-inch tube with an internal (parallax-free) graticule. Unless otherwise ordered, the tube is supplied with a medium persistence (P-2) phosphor and light blue filter.

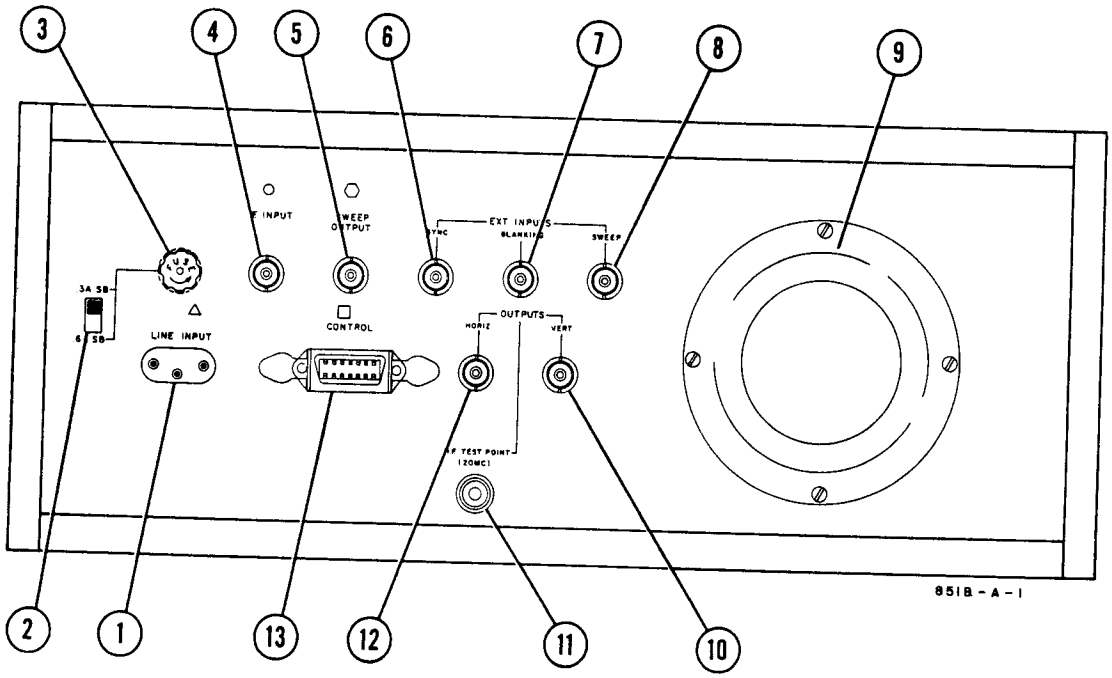
3-17. TIME BASE. Time-base range is from 3 milliseconds/centimeter to 1 second/centimeter, and is selected with the SWEEP TIME switch. The time base can be synchronized with an internal or externally-supplied signal, or line frequency. For photographic use, a single-sweep mode is provided; selection of mode is made with the SYNC switch.

3-18. ALIGN AND BASE LINE CLIPPER CONTROLS. In addition to the usual oscilloscope controls, the



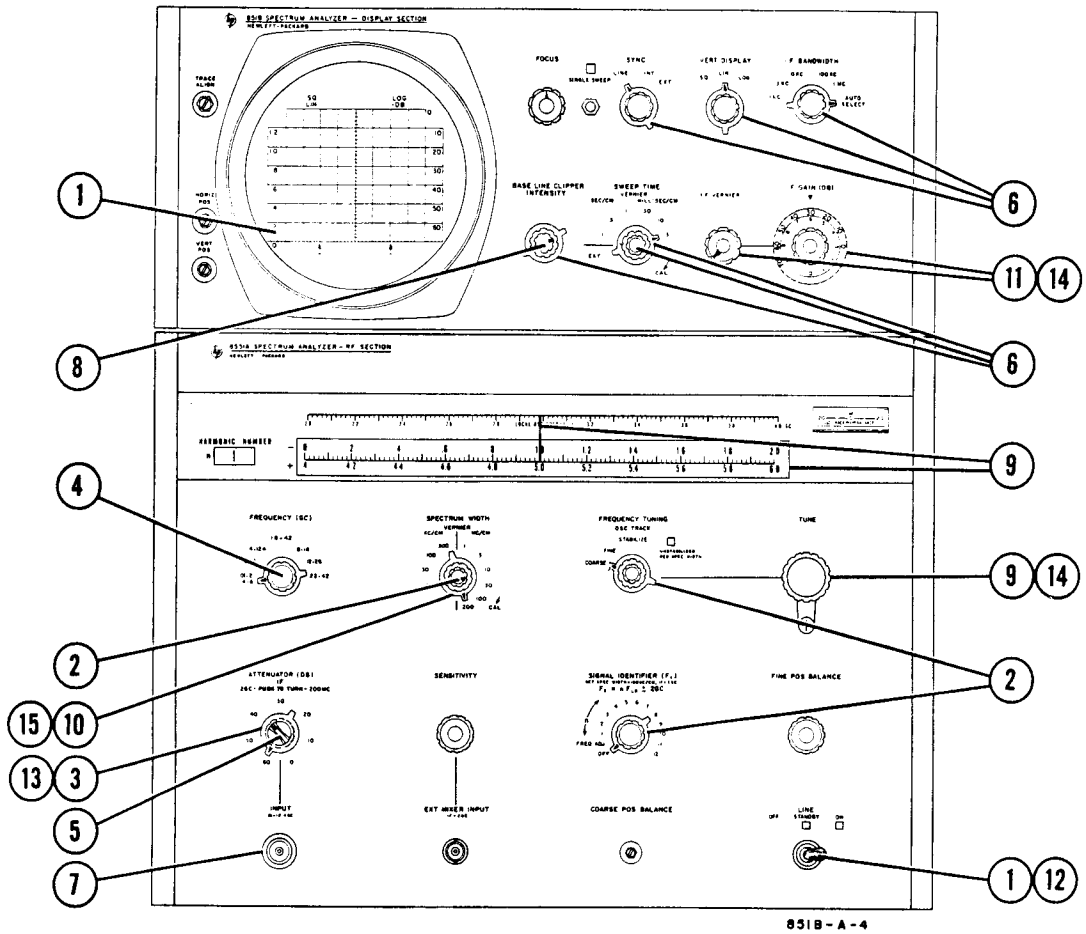
1. CRT:
   a. Scale used with VERT DISPLAY at SQ or LIN.
   b. Markers used in signal-identification technique. (See Manual for 8551 RF Section.)
   c. Scale used with VERT DISPLAY at LOG.
2. To blank base line, turn clockwise.
3. Adjusts brightness of trace.
4. Adjusts focus of trace.
5. To obtain one nonrecurring sweep, set SYNC at SINGLE SWEEP, and depress pushbutton.
6. Lights when single sweep starts, goes out when single sweep ends.
7. SYNC:
   a. SINGLE SWEEP: sets up internal connections for single-sweep operation.
   b. LINE, INT, EXT: sets up internal connections for type of sync voltage selected. For EXT operation, input (SYNC INPUT) is on rear panel.
8. From six sweep rates, selects time base for horizontal sweep. At EXT, sets up internal conditions required when using sweep voltage supplied from external source. VERNIER provides continuous adjustment between calibrated steps. Note: At EXT, apply sweep voltage to SWEEP input on rear panel, and compatible blanking pulse to BLANKING input, also on rear panel.
9. Selects vertical calibration:
   LIN: amplitude proportional to voltage
   SQ: amplitude proportional to power
   LOG: amplitude proportional to logarithm of input signal; level indicated in db.
10. I. F. BANDWIDTH switch:
    1 KC to 1 MC: manual selection of I. F. bandwidth
    AUTO SELECT: automatic selection, for CW signals, of optimum I. F. bandwidth for chosen SPECTRUM WIDTH (on 8551) and SWEEP TIME settings.
11. Vernier for I. F. GAIN (DB): as vernier is turned cw, up to 1 db of additional gain is inserted.
12. Controls I. F. input attenuator, in 10-db and 1-db steps.
    Highest gain setting: 70 + 10
    outer control at 70, inner at 10
    Max atten setting: both controls at 0
13. Position adjustments: HORIZ POS shifts trace to right or left; VERT POS shifts trace up or down.
14. Adjusts trace angularly, enabling operator to align trace with graticule horizontal axes.

Figure 3-1. Front Panel Controls, Connectors, and Indicators, Model 851B Spectrum Analyzer Display Section



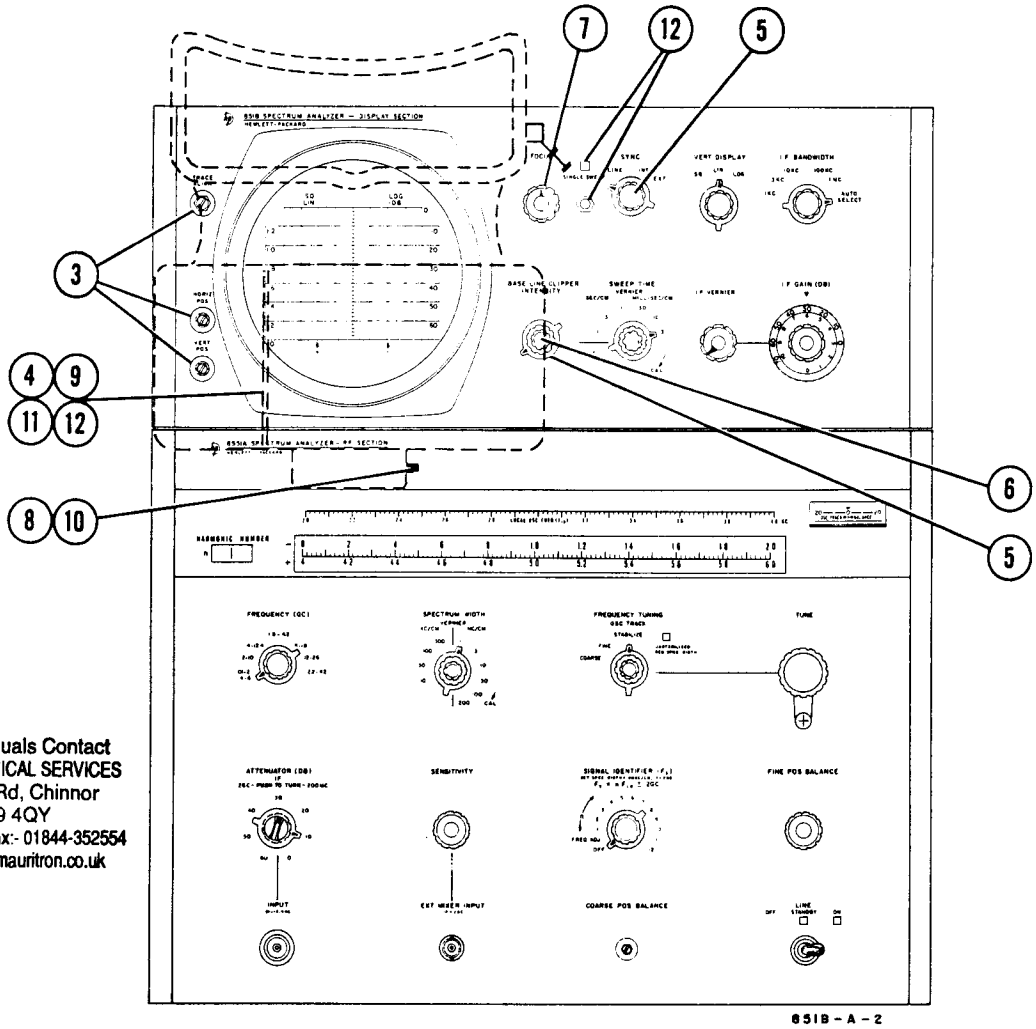
1. △ J4: power cable connects here. Cable supplied with 851B.
2. S1: Line Voltage slide switch: controls power-supply input connections. Always check that switch is set for nominal voltage of external power source.
3. Fuseholder: rating of fuse is marked at the Line Voltage switch setting which corresponds to voltage of power source.
4. ○ J1: cable for carrying 20-Mc I. F. signal from RF Section connects here. Cable supplied with RF Section.
5. ⬡ J7: cable carrying sweep voltage from 851B to RF Section connects here. Cable supplied with RF Section.
6. J6: input for external sync signal; requirements: positive-going pulse of between 3 volts peak and 15 volts peak.
7. J3: input for externally-supplied blanking voltage; requirements: negative 5- to 10-volt pulse, width of which is compatible with retrace time of external sweep voltage used.
8. J2: input for externally-supplied sweep voltage; requirements: 0 to approximately +15V sawtooth from 10,000-ohm source.
9. CRT protective cover; may be removed for servicing and/or tube replacement.
10. J10: signal to CRT, sampled at output of video detector in 20 MC I. F. Amplifier just ahead of Vertical Amplifier; 0 to -4 volts open circuit, 4700 ohms impedance; BNC female. With high-impedance earphones, output can be used to monitor modulated signals tuned in on Analyzer.
11. J5: for sampling 20-Mc I. F. signal just ahead of Video Detector; BNC female.
12. J8: sweep voltage, sampled just ahead of Horizontal Amplifier; 10 volts ±3V peak-to-peak open circuit, 4700 ohms impedance; BNC female. Note: With appropriate amplifier, VERT and $\overline{\text{HORIZ}}$ outputs will drive an X-Y recorder to obtain an X-Y plot of spectrum displayed on CRT.
13. □ J9: 14-conductor cable connects here; carries ±15 vdc to RF Section, and SWEEP TIME/SPECTRUM WIDTH connections required for I. F. bandwidth AUTO SELECT operation. Cable supplied with RF Section.

Figure 3-2. Switches and Connectors, Rear Panel, 851B



1. LINE: set to STANDBY; light should glow, fan turn. After about 10 seconds, base line should appear on CRT. CAUTION: Before setting LINE to ON (step 12), be sure fan is turning; BWO can be damaged if fan is not operating.
2. Set: SIGNAL IDENTIFIER . . . . . OFF
   FREQUENCY TUNING . . . . . COARSE
   SPECTRUM WIDTH VERNIER . . . . CAL
3. ATTENUATOR (DB): Set to 60. Be sure switch seats in detent.
4. Set range switch, FREQUENCY (GC).
5. Set I. F.
   a. 200 MC if FREQUENCY (GC) is at 1.8 - 4.2
   b. 2 GC for all other inputs.
6. Set: BASE LINE CLIPPER . . . . . max ccw
   SYNC . . . . . LINE
   I. F. BANDWIDTH . . . . AUTO SELECT
   VERT DISPLAY . . . . LIN, LOG, or SQ
   SWEEP TIME . . . . . 3 MILLISEC/CM
   VERNIER . . . . . CAL
7. Connect signal under investigation; range: 10 Mc to 10 Gc. CAUTION: Input must not exceed 1 watt average with ATTEN (DB) set at 60; see Manual for 8551 RF Section.
8. INTENSITY: Set at about 3 o'clock.
9. If input frequency is unknown, set TUNE to about 3 on LOCAL OSC FREQ scale; if known, set TUNE for Frequency Scale reading near that of input signal.
10. Set SPECTRUM WIDTH for 200MC/CM.
11. Set I. F. GAIN (DB) at 70 or 80, I. F. VERNIER max ccw.
12. Set LINE to ON; indicator light will glow. When TUNE is at 2 Gc, large signal will appear; this is the BWO signal used for self-check, and can be ignored.
13. ATTENUATOR (DB): Adjust to bring signal on CRT. CAUTION: Attenuator must be set for sufficient loss to reduce input signal to 1 mw or less.
14. Set I. F. GAIN for convenient signal-to-noise ratio, and adjust TUNE to center signal on CRT.
15. Adjust SPECTRUM WIDTH for best detail in region of interest. If display shifts position, check COARSE POS BALANCE (see Paragraph 5-125, 851A/8551A Manual). (COARSE POS controls range-to-range position.)

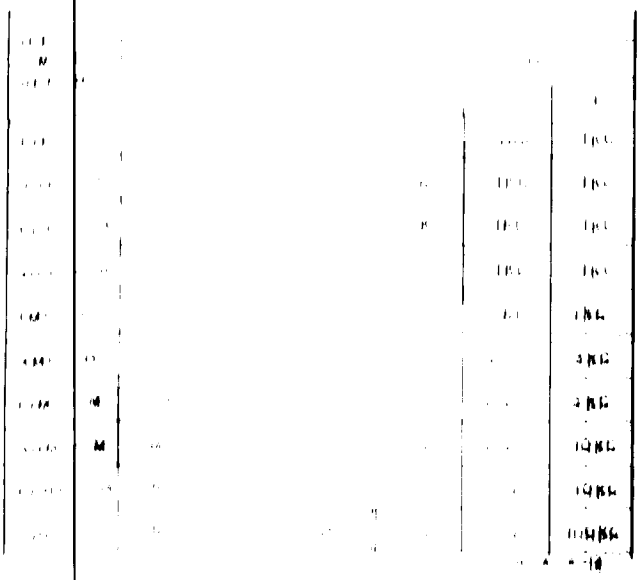
Figure 3-3. Initial Operating Procedure for 10-Mc to 10-Gc Inputs, Model 851/8551 Spectrum Analyzer



Note: Before taking pictures, read Paragraph 3-22.

1. Perform steps 1 through 14 of initial operating procedure, Figure 3-3; refer to information on input signal levels in 8551 Manual.
2. If 8551 SPECTRUM WIDTH is set for 1 MC/CM or less, stabilize the Analyzer; see Figure 3-5, 8551 Manual.
3. Align trace, and adjust SWEEP TIME, SPECTRUM WIDTH, I. F. GAIN for detail of interest.
4. Install and align Oscilloscope Camera. Load film pack; Polaroid ASA 3000 is recommended.
5. Set:
   SYNC. . . . . .SINGLE SWEEP
   BASE LINE CLIPPER . . . cw until base line is blanked
6. Adjust INTENSITY so fast transients in waveform almost disappear.
7. Adjust FOCUS for finest trace.
8. Depress ultra-violet light pushbutton on camera; determine exposure required when graticule is illuminated by ultra-violet light and no sweep is present. For Polaroid's ASA 3000, about 1/5 second at F11 is recommended.
9. After setting camera, depress ultra-violet light pushbutton, and hold it on until phosphor glows. Photograph the graticule.
10. Release ultra-violet light.
11. Set camera for photographing the trace. Exposure required is a function of sweep speed and intensity.
12. Open camera shutter, depress SINGLE SWEEP pushbutton, and watch SINGLE SWEEP light. When light goes out, close shutter.

Figure 3-4. Photographic Procedure, Model 851/8551 Spectrum Analyzer



OPERATING INSTRUCTIONS

PHOTOGRAPHIC TECHNIQUES

SECTION IV
PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. The Model 851/8551 Spectrum Analyzer receives and scans signals in the 10-Mc to 42-Gc range, and displays the amplitude of signal components as a function of frequency. In the same display the Analyzer can present signals which vary up to 2 Gc in frequency and up to 60 db in amplitude. The Analyzer is shown in block diagram form in Figure 4-1.

4-3. RF SECTION. The scanning receiver is the 8551 RF Section; it is a triple-conversion, narrow-band superheterodyne receiver. Tuning and width of frequency range displayed are controlled by circuits in the RF Section. Amplitude-vs-frequency information over a selected portion of the frequency spectrum is obtained by sweeping the first local oscillator between 2 and 4 Gc. Sweep voltage to drive the first Local Oscillator (a backward-wave oscillator) is supplied by the 851 Display Section, and is the same voltage used to drive the 851 CRT horizontal plates; this arrangement maintains frequency calibration of the CRT display. The 8551 heterodynes the input signal and its components to an I. F. of 20 Mc. The 20-Mc I. F. is carried by external jumper cable to the 851 Display Section.

4-4. DISPLAY SECTION. Figure 4-2 is a block diagram which relates the Display Section to its schematic diagrams.

a. I. F. Input Attenuator. In the Display Section, the 20-Mc I. F. is first applied to an attenuator which is calibrated as a gain switch [I. F. GAIN (DB)]. The I. F. attenuator includes a two-section switch (see Figure 5-16) which inserts attenuation from 0 to 80 db in 1-db steps. I. F. VERNIER, which provides up to 1-db adjustment between steps, and which is associated with the I. F. GAIN switch, is not in the input circuit; it is in the final 20-Mc I. F. Amplifier, and attenuates the signal just ahead of the Video Detector (see Figure 5-27).

b. Bandwidth Switching Circuits. Following the I. F. attenuator is the first 20-Mc I. F. Amplifier, bandwidth of which is selected with the I. F. BANDWIDTH switch. Amplifier bandwidth determines the resolution of the display; the narrower the bandwidth, the more detailed the presentation of the frequency distribution of signal and components. Variation in 20-Mc I. F. Amplifier bandwidth is provided by a set of bandpass filters which are connected into the Amplifier circuit by relays (see Figure 5-24). The relays are controlled by the I. F. BANDWIDTH switch; with no relays energized, 20-Mc I. F. Amplifier bandwidth is 10 Kc. In addition to the 10-Kc bandwidth, 1-Kc, 3-Kc, 100-Kc, and 1-Mc bandwidths can be selected. Or an automatic bandwidth selection system can be used which selects that I. F. bandwidth which will provide optimum display for whatever SPECTRUM WIDTH and SWEEP TIME settings are selected. (As used here, optimum is the narrowest bandwidth which does not attenuate the signal because of limitations in the rise time of the 20-Mc I. F. Amplifier.) With I. F. BANDWIDTH at AUTO SELECT, current to operate the bandwidth-switching relays is brought through contacts on the SWEEP TIME switch and on the 8551 SPECTRUM WIDTH switch as well as through contacts on I. F. BANDWIDTH; connections for this mode of operation are carried in the inter-unit CONTROL cable.

Note

The narrower the I. F. bandwidth, the more the incoming signal is attenuated if the tuning is too fast.

c. Display Calibration. The Analyzer Display Section provides a choice of display calibration, thus making it possible to present in the same display responses with a difference of up to 60 db. The switch from linear calibration to logarithmic (or square) calibration is made with the VERT DISPLAY switch. The signal is converted to the proper ratio by the Current-Controlled Attenuator (see Figure 5-27); this circuit includes diodes which shunt the signal path. The diodes act as variable resistors whose resistance depends on the bias current supplied. For a linear display, bias current is fixed. For log or square displays, bias current is changed by shaping the output voltage of the video amplifier and applying it to the current-controlled attenuator. The shaping circuits are discussed in more detail in Paragraph 4-15.

d. Video Signal.

(1) From the Current-Controlled Attenuator, the 20-Mc I. F. signal passes to the final 20-Mc I. F. Amplifier, the Video Detector (A2A7T1 and A2A7CR1-A2A7CR4), and the Video Amplifier. These circuits are shown in Figure 5-27.

(2) Two outputs from the 20-Mc-to-Video signal path are provided: 1) I. F. TEST POINT, which samples the 20-Mc I. F. just ahead of the Video Detector, and 2) VERT OUTPUT, which samples the Video signal at the output of the Video Amplifier, just ahead of the Vertical Amplifier.

(3) In the Vertical Amplifier (Figure 5-29), the video signal is applied to the base of A7Q8 in differential amplifier A7Q8-A7Q9; the signal on the base of A7Q9 is determined by the setting of VERT POS adjust R8. Vert Gain adjust A7R15 in the emitter circuit of differential amplifier A7Q8-A7Q9 is adjusted when calibrating the Vertical Amplifier (see Paragraph 5-80). A variable RC network in the emitter circuit of the final stage of the Vertical Amplifier, A7Q6-A7Q7, provides further filtering of the video signal before it is applied to the CRT vertical deflection plates. Selection of capacitor for the RC filter is controlled by I. F. BANDWIDTH.

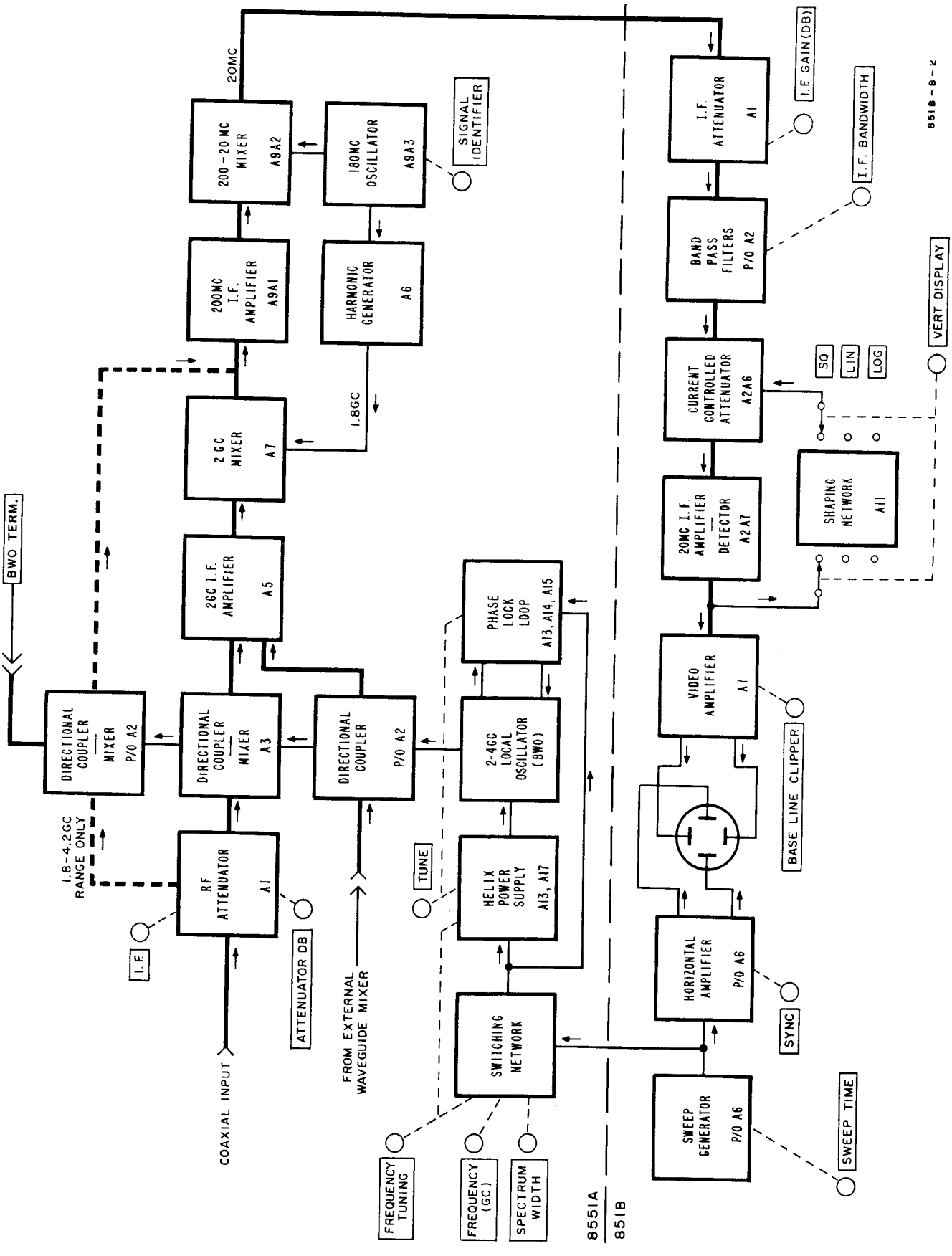


Figure 4-1. Model 851B/8551A Spectrum Analyzer, Block Diagram

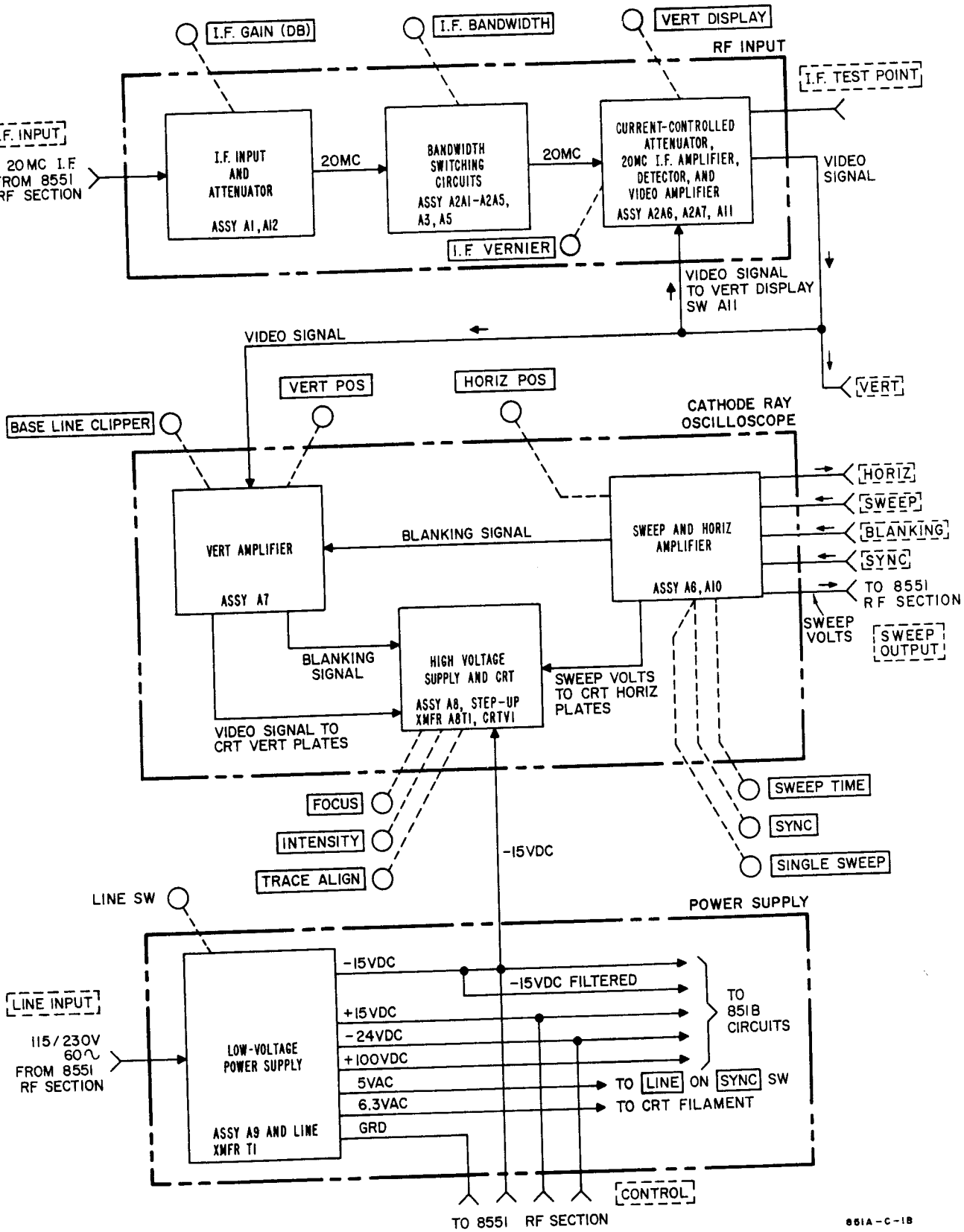


Figure 4-2. Model 851B Spectrum Analyzer Display Section, Block Diagram

e. Sweep and Horizontal Amplifier. This circuit (see Figure 5-33) generates the sweep voltage and blanking signal.

(1) Rate of sweep generated is determined by RC networks connected into the sweep-generating circuit by SWEEP TIME switch A10S1. Connections for the type of SYNC voltage selected are set up by SYNC switch S2. Operation of the Sweep Generator is discussed in Paragraph 4-5.

(2) Sweep voltage for driving the first Local Oscillator (BWO) in the 8551 RF Section is taken at the output of the Sweep Generator, just ahead of the Horizontal Amplifier. This voltage appears at SWEEP OUTPUT on the rear panel, and is carried by inter-unit SWEEP cable to the 8551. Sweep voltage, sampled at the same point in the circuit, appears also at the HORIZ output connector on the rear panel.

(3) Horizontal Amplifier A6Q16-A6Q18 is a differential amplifier. Sweep voltage is applied to the base of A6Q16, and the signal on the base of A6Q18 is determined by the setting of HORIZ POS adjust R9. Horiz Gain adjust A6R54 in the collector circuit of the Amplifier is adjusted when calibrating the Horizontal Amplifier (see Paragraph 5-50). Amplified sweep voltage is applied to the CRT horizontal deflection plates.

(4) The blanking signal, taken from the emitter of A6Q6, is amplified by A7Q3 on the Vertical Amplifier Board (see Figure 5-29) before it is applied to the CRT.

(5) Via contacts at the EXT position of SWEEP TIME, sweep voltage from a suitable external source, such as one of the hp 690 Sweep Oscillators, can be applied to the Horizontal Amplifier to drive CRT horizontal plates. The CRT requires a sawtooth voltage of from 0 to +15 volts. Inputs for sweep voltage and compatible blanking signal are on the 851B rear panel.

4-5. OPERATION OF HORIZONTAL SWEEP GENERATOR.

4-6. The Horizontal Sweep Generator is shown in block-diagram form in Figure 4-3; the schematic is Figure 5-33.

4-7. EXTERNAL.

4-8. With SYNC at EXT, a positive input signal will cause Schmitt Trigger A6Q1, A6Q2 to generate a

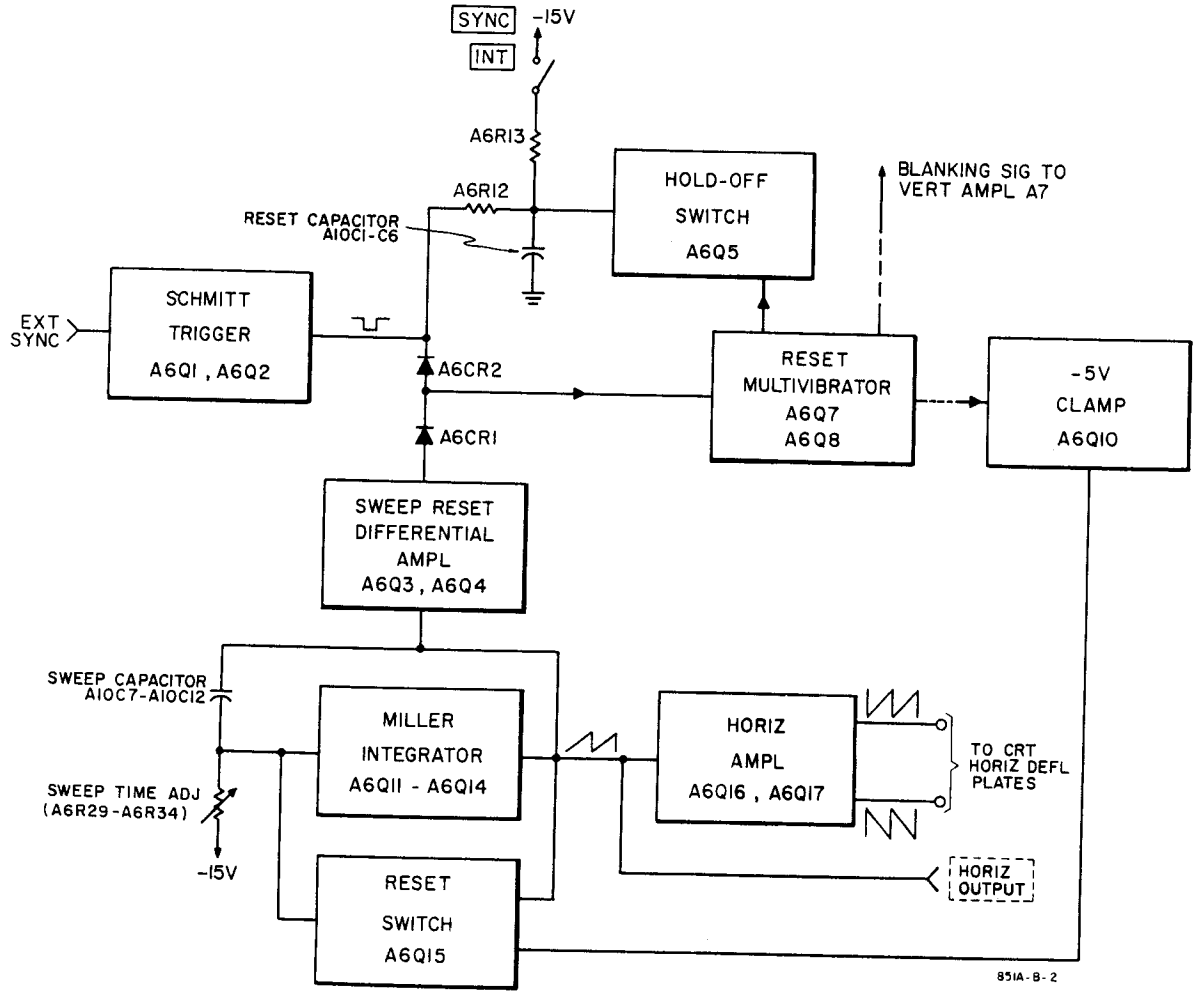


Figure 4-3. Horizontal Sweep Generator, Block Diagram

negative trigger pulse at the collector of A6Q1. The negative pulse is coupled through A6CR2 to the base of A6Q7, one half of a bistable multivibrator. The negative pulse turns A6Q7 off and A6Q8 on.

4-9. When A6Q7 turns off, it turns off A6Q6. This cuts off the blanking signal, allowing the horizontal sweep to be seen on the CRT if the base line clipper has not biased off the CRT.

4-10. When A6Q8 turns on, Pulse Amplifier A6Q9 conducts, turning off -5V Clamp A6Q10. When A6Q10 turns off, its emitter goes positive, biasing off Reset Switch A6Q15. When the Reset Switch cuts off, the Sweep Capacitor (A10C7-A10C12) in the base circuit of A6Q11 starts to charge, applying a negative-going signal to the base of A6Q11.

4-11. Transistors A6Q11, A6Q12, A6Q13, and A6Q14 form a Miller Integrator. The output of A6Q14 is a positive-going ramp. The positive ramp voltage is fed back to the Sweep Capacitor (A10C7-A10C12). As the Sweep Capacitor charges negatively on its bottom plate, the top of the capacitor is going positive. The result is that the voltage drop across R35 and A6R29-A6R34 is almost constant as the Sweep Capacitor charges. If the voltage drop is constant, the current through the resistors is constant. This same current is the charging current for the Sweep Capacitor. If the charging current is constant then the capacitor is charging linearly and a linear ramp voltage out of the Miller Integrator is the result.

4-12. The positive ramp fed back to the Sweep Capacitor also goes to the base of A6Q4, one half of the Sweep Reset Multivibrator. The signal is amplified and appears as a positive-going voltage at the collector of A6Q3. The signal is coupled through A6CR1 and delivered to the base of A6Q7. When the sweep voltage from the Miller Integrator circuit reaches a predetermined level, A6Q7 starts to conduct. The conduction of A6Q7 cuts off A6Q8. This causes Pulse Amplifier A6Q9 to cut off, turning on the -5V Clamp, A6Q10. When A6Q10 conducts it turns on Reset Switch A6Q15 which discharges the Sweep Capacitor, ending the sweep. At the time A6Q7 turns on it turns on A6Q6, blanking the CRT during retrace.

4-13. INTERNAL.

4-14. With SYNC at INT, operation of the sweep circuit is essentially the same except that no external trigger is needed to turn off A6Q7.

a. With SYNC at INT, the Reset Capacitor (A10C1-A10C6) is connected through A6R13 to the -15V supply. As the Reset Capacitor charges negatively, the voltage is coupled through A6R12 and A6CR2 to the base of A6Q7. This triggers A6Q7 and starts the sweep. Sweep termination is the same as when operating from an external trigger.

b. The one other difference in operation is that the conduction of A6Q8 also turns on A6Q5, discharging the Reset Capacitor until the end of sweep. At the end of sweep when the Reset Multivibrator flips back, A6Q5 is cut off, allowing Reset Capacitor (A10C1-A10C6) to charge negatively again and restart sweep.

4-15. OPERATION OF VERTICAL DISPLAY.

4-16. CURRENT-CONTROLLED ATTENUATOR.

4-17. Between the first and second 20-Mc I. F. Amplifiers, the 20-Mc I. F. is passed through the Current-controlled Attenuator (see Figure 5-27). The attenuating element is a network of hot carrier diodes which shunt the signal path.

4-18. Hot carrier diodes are used because they have very low shunt capacity and a very predictable dynamic resistance-vs-current characteristic. This predictable characteristic makes it possible to design shaping circuits which will give the desired attenuation characteristics in the LOG and SQuare modes of operation.

4-19. Figure 4-4 shows a dynamic resistance-vs-current curve for a hot carrier diode. As current through the diodes increases, dynamic resistance decreases. In the Current-Controlled Attenuator, lower diode resistance causes more signal shunting, i.e., more attenuation of the signal.

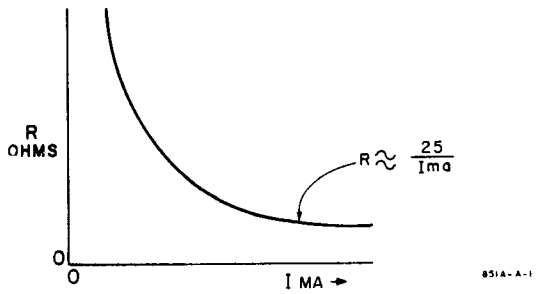


Figure 4-4. Typical Dynamic Resistance-vs-Current Curve, Hot Carrier Diodes

4-20. SQUARE MODE OF OPERATION.

4-21. The purpose of the SQuare mode of operation is to convert the voltage (linear) indication on the CRT to a voltage-squared display representing power. If two signals are present with a voltage ratio of 2:1 (VERT DISPLAY at LIN), at SQ they will appear on the CRT as signals with a 4:1 ratio.

4-22. To achieve this change in the display, the amount of current to the Current-Controlled Attenuator must decrease with an increase in signal level.

4-23. The video signal into the VERT DISPLAY Switch Assembly is negative-going. A negative signal on the base of A11Q2 (see Figure 4-5) will increase its conduction. This will decrease current through A11CR1, A11CR2, and A11Q1; this current flows through the hot carrier diodes in the Current-Controlled Attenuator. Larger signals will cause a much greater decrease in current through the Attenuator diodes than small signals. Shaping circuit characteristics are such that any increase in signal level will cause the square of the increase to appear on the CRT. For example, as the signal goes from 1 to 2 in voltage, the decrease in shaping circuit current is such that four times as much signal gets through the Attenuator. In general, any increase in signal level will cause the square of the increase to appear on the CRT.

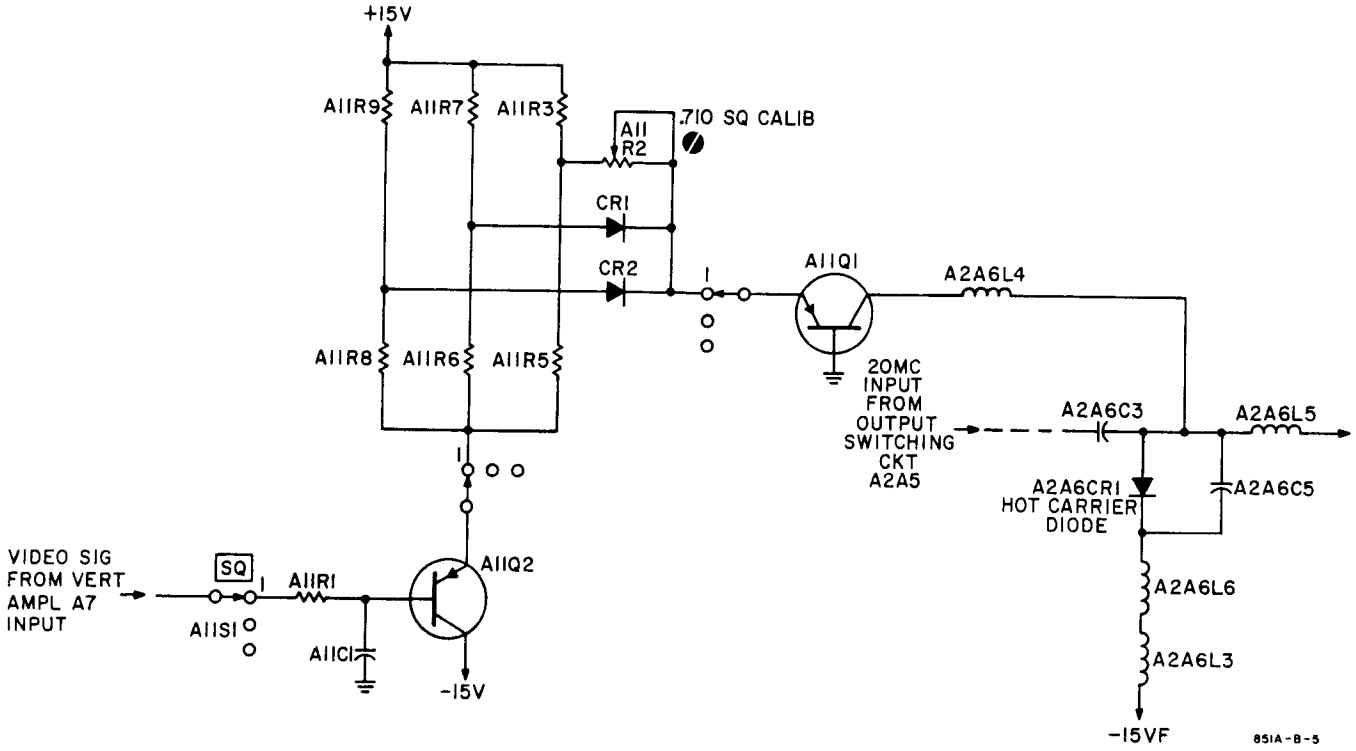


Figure 4-5. VERT DISPLAY Switch at SQ, Simplified Schematic

4-24. LOGARITHMIC MODE OF OPERATION.

4-25. The purpose of the LOG mode of operation is to convert the incoming voltage to bias current of such value that the resulting display is proportional to the log of the input voltage. To achieve such a display, larger signals must cause much greater attenuation than small signals; that is, as signal level increases, a much greater amount of current must flow through the diodes in the Attenuator. With VERT DISPLAY at LOG, current out of the shaping circuit is such that gain through the Current-Controlled Attenuator is logarithmic; that is, for each 10 db of change in signal level there is a 1-centimeter change in signal display.

4-26. Refer to the simplified schematic of VERT DISPLAY at LOG, Figure 4-6. The video signal fed back to A11Q1 is negative-going. As A11Q1 conducts more, diodes A11CR3 and A11CR4 are biased on. When they conduct, they decrease the emitter resistance of A11Q1, increasing the gain. This causes proportionately more current to flow through the Attenuator hot carrier diodes on large signals than on small. The shaping circuit in the emitter of A11Q1 is designed to provide a logarithmic gain through the Current-Controlled Attenuator.

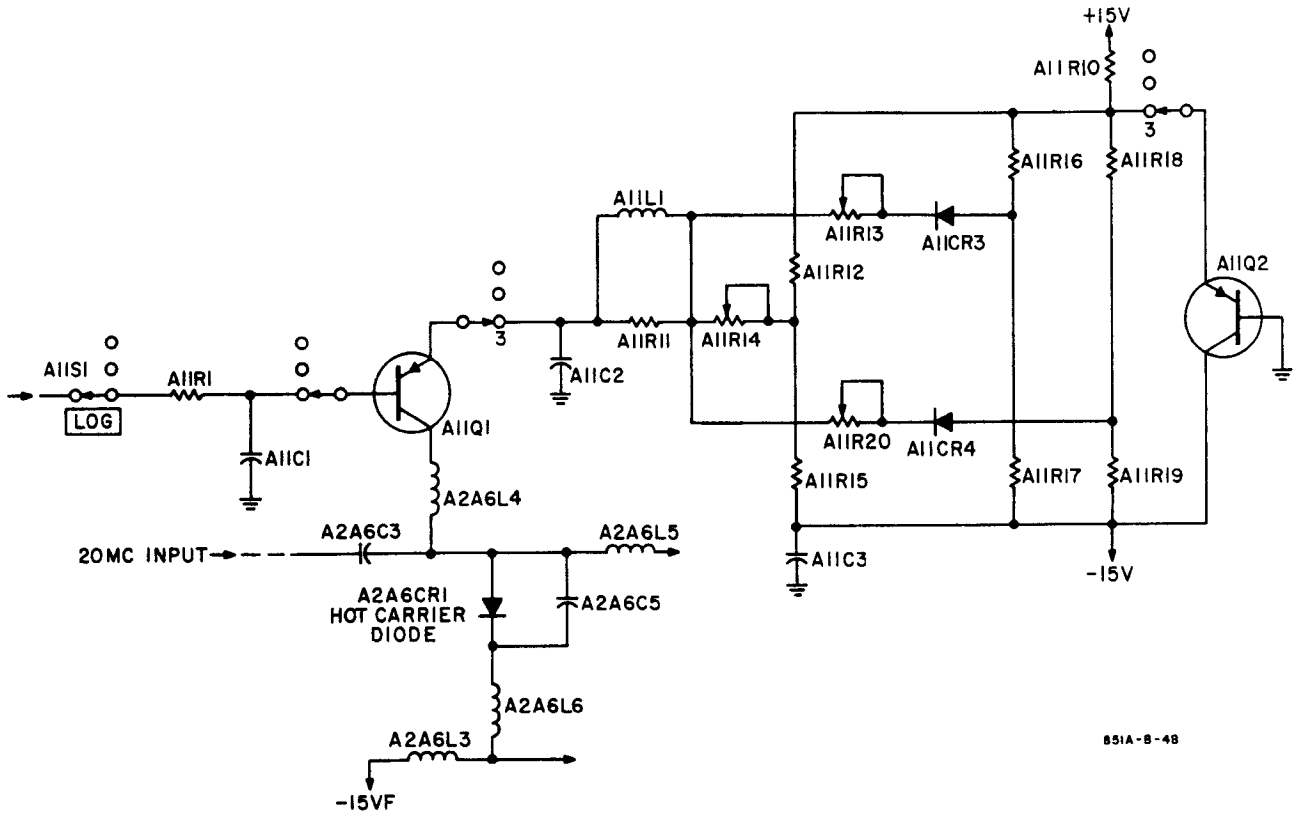


Figure 4-6. VERT DISPLAY Switch at LOG, Simplified Schematic

Table 5-1. Test Equipment Required

Ref No.	Instrument Type	Critical Specifications	Recommended Equipment
1	Oscilloscope Low-Frequency	Sensitivity: 0.1 mv/cm	hp 130C 200 μv/cm Oscilloscope
2	DC Voltmeter	Accuracy: 0.05% Input Impedance: 10.2 megohms Automatic Range Selection Range: to 150V	hp 3440A Digital Voltmeter with hp 3442A Automatic Range Selector Plug-In
3	Transformer for varying input voltage	Range: 103 to 253 VAC at approx 1/2 amp Voltmeter Range: 103 to 127 volts Voltmeter Accuracy: ±1 volt	General Radio Type W10MT3A Superior Electric UC1M
4	Clip-On DC Milliammeter	Accuracy: ±0.1 ma ±3% of FS	hp 428B
5	DC Voltmeter	Accuracy: ±2% of FS Input Resistance: 100 megohms Can accommodate voltage-divider probe	hp 410C Electronic Voltmeter
6	DC Voltage Divider	Accuracy: ±5% Division Ratio: 100:1 Input Resistance: 10,000 megohms Max Volts: 6000	hp 11045A DC Voltage Divider
7	Electronic Counter	Frequency: 200 Mc Accuracy: 5 parts in 10^8 ±1 count Multiple period averaging feature	hp 5245L Electronic Counter and hp 5253B Frequency Converter
8	Low-Frequency Oscillator	Frequency Range: 1 cps to 350 cps, continuously variable Output: 5 volts peak Distortion: less than 0.5% above 5 cps	hp 202C
9	HF Signal Generator	Output Frequency: 50 Kc to 20 Mc Frequency Accuracy: ±1% Output: at least 3 volts into 50 ohms Modulating capability with external modulating voltage input Meter which monitors generator output level	hp 606A
10	VHF Attenuator	To 60 db, in 10-db steps, at 2 Gc	hp 355D
11	UHF Signal Generator	Frequency: 2 Gc	hp 8614A
12	Precision 10-db/ Step Attenuator	Accuracy at 20 Mc: 0-10 db, ±0.02 db 10-20 db, ±0.03 db 20-70 db, ±0.03 db + 0.03 db/20 db	hp H25-355D VHF Attenuator
13	Precision 1-db/ Step Attenuator	Accuracy at 20 Mc: ±0.02 db	hp H25-355C VHF Attenuator

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. Information required to maintain the 851 Spectrum Analyzer Display Section in working condition is provided in this section. Type of information covered is summarized briefly in Paragraph 5-5.

5-3. "Right" and "left", "backward" and "forward" as used in this section are with respect to the instrument as seen by the operator when he is facing the front panel and the instrument is in its normal (upright) position.

5-4. Unless otherwise specified, test procedures assume the 851 is connected to a 115 or 230-volt, 50- to 1000-cycle, approximately 25-watt source.

5-5. CONTENT.

a. Performance Checks. Tables 5-6 and 5-7; Paragraphs 5-9 through 5-34.

b. Checks and Adjustments. Procedures are given in brief form in Table 5-13 and, in more detail, in Paragraphs 5-37 through 5-130.

c. Required Test Equipment. Instruments required for tests and adjustments are listed and briefly specified in Table 5-1; each instrument is given a number reference. Accessories required for the procedures are listed in Table 5-2; each accessory is given a letter reference. Ahead of each section of the procedure, equipment required is listed by its reference number or letter.

d. Schematics. Inserted at the end of Section V, ahead of the Replaceable Parts Lists (Section VI).

e. Waveforms. Table 5-25.

f. Assembly and Component Identification. Silk-screening on the instrument identifies Assemblies and parts plainly and thoroughly. In addition, the following aids are provided.

(1) Location of Assemblies is called out in Figures 5-10 and 5-11.

(2) Table 5-3 lists Assemblies numerically and gives the schematic or schematics on which each is shown.

(3) Table 5-4 lists controls, switches, and connectors alphabetically and gives the schematic on which each is shown.

(4) Table 5-5 lists each chassis-mounted component numerically by reference designation, and references the schematic on which each is shown, and either tells where the part is located or references an illustration which calls out the part.

(5) Each Board-mounted component is called out on a picture of the Board. In the main, these illustrations face the schematic in which the Assembly appears. For help in locating the illustration for a given Board, refer to the List of Illustrations in the front of the Manual. Paragraph 5-134 includes suggestions on how to proceed when it is necessary to locate a part.

g. Troubleshooting Information, Disassembly Instructions. Paragraphs 5-131 through 5-157.

5-6. COVER AND SIDE PANEL REMOVAL.

a. Equipment Required: Phillips driver No. 2.

b. Top Cover Removal.

(1) Remove four phillips head screws (6-32 x 7/16").

(2) Slide cover to rear, and off instrument.

c. Side Panel Removal. After removing the top cover, from each panel remove the four phillips head screws (6-32 x 3/16"). The side panels lift off.

d. Bottom Plate Removal.

(1) Remove the four phillips head screws (6-32 x 7/16").

(2) Push plate to rear, and off instrument.

5-7. PERFORMANCE CHECKS.

5-8. Operational checks for incoming or routine inspection are given in Table 5-6, and procedures for verifying that the 851 meets specifications are given in Table 5-7. Both sets of procedures are spelled out in greater detail in Paragraphs 5-9 through 5-34. Both Tables reference the more detailed procedures as an aid in case brevity has obscured clarity. Table 5-7 is in test-card form, briefly describes test sequences, and provides space for recording measurement results.

5-9. OPERATIONAL CHECKS.

5-10. INTENSITY CONTROL.

a. Set 8551 LINE to ON.

b. Set INTENSITY maximum cw.

c. Turn SWEEP TIME through its range, and watch display for retrace.
There should be no retrace at any setting of of SWEEP TIME.

d. Set INTENSITY maximum ccw.
No trace should be visible.

5-11. BASE LINE CLIPPER.

a. Perform steps 1 through 14 of initial turn-on procedure (see Figure 3-3), using any signal from 10 Mc to 10 Gc.

b. Set I. F. GAIN (DB) at 70.

Table 5-2. Test Accessories Required

Ref No.	Instrument Type	Critical Specifications	Recommended Equipment
A	Cable Assembly (2 each)	Shielded 50-ohm cable terminated with dual banana plugs	hp 11000A
B	Cable Assembly	Shielded 50-ohm cable, dual banana plug to alligator clips	hp 11037A
C	Cable Assembly (3 each)	RG-58C/U, BNC male to dual banana plug	hp 11001A
D	Cable Assembly	RG-58C/U, BNC male to BNC male	hp 10503A
E	Adapter	BNC female to dual banana plug adapter	hp 10111A
F	BNC Tee	BNC male to 2 BNC females	UG-274A/U, hp 1250-0072
G	Plastic tuning wand	Approx 7" long x 3/8" diam plastic	Modified* General Cement #GC8721
H	Cable Assembly	Shielded coax, type N male to type N male, 3 feet long	Special hp 11500A
J	Adapter	BNC male to male	UG-491A/U
K	Screwholding Screwdriver		Quick Wedge 1734-XM or 736-50

* One end modified by cutting shield away, exposing tuning blade.

Table 5-3. Assemblies vs Schematics, 851B

Assy No.	Designation	Schematic	Figure No.
A1	I. F. GAIN Switch Assy	I. F. Input and Attenuator	5-20
A2	RF Circuit Assembly	I. F. BANDWIDTH Switching Circuits VERT DISPLAY Switch, Current-Controlled Attenuator, and 200MC I. F. Amplifier Assemblies	5-24 5-27
A3	100-Kc Bandpass Filter Assy	I. F. BANDWIDTH Switching Circuits	5-24
A4	I. F. BANDWIDTH Switch Assy	I. F. BANDWIDTH Switching Circuits I. F. BANDWIDTH Switch A4S1	5-24 5-38
A5	100-Kc Bandpass Filter Assy	I. F. BANDWIDTH Switching Circuits	5-24
A6	Sweep and Horizontal Amplifier Assy	Sweep and Horizontal Amplifier	5-33
A7	Vertical Amplifier Assy	Vertical Amplifier	5-29
A8	High-Voltage Board	High-Voltage Power Supply	5-35
A9	Low-Voltage Board	Low-Voltage Power Supply	5-37
A10	SWEEP TIME Switch Assy	Sweep and Horizontal Amplifier SWEEP TIME Switch A10S1	5-33 5-30
A11	VERT DISPLAY Switch Assy	VERT DISPLAY Switch, Current-Controlled Attenuator, and 20MC I. F. Amplifier Assemblies	5-27
A12	Bandpass Filter Assy	I. F. Input and Attenuator	5-20

[illegible] ols, Switches, and [illegible]

Name	Ref Desig	
BASE LINE CLIPPER	R7	Vertical [illegible]
BLANKING Input	J3	Sweep & [illegible]
CRT	V1	HV Power [illegible]
FOCUS	R4	HV Power [illegible]
HORIZ Output	J8	Sweep & [illegible]
HORIZ POS	R9	Sweep & [illegible]
I.F. BANDWIDTH	A4S1	Switch [illegible]
I.F. GAIN DB [illegible]	A1S1 A1S2	I.F. Input [illegible]
I.F. INPUT	J1	I.F. Input [illegible]
I.F. TEST POINT	J5	VERT DISP Attenuator
I.F. VERNIER	R10	VERT DISP Attenuator
INTENSITY	R1	HV Power
LINE INPUT	J4	LV Power
Line Switch (LI)	S1	LV Power
SINGLE SWEEP [illegible]	S3	Sweep & H
SWEEP OUTPUT	J7	Sweep & H
SWEEP TIME Switch	A10S1	Sweep & H
SWEEP TIME VERNIER	A10R1	Sweep & H
SYNC Input	J6	Sweep & H
SYNC Switch	S2	Sweep & H
TRACE ALIGN	R5	HV Power
VERT DISPLAY Switch	A11S1	VERT DISP Attenuator
VERT Output	J9	Vertical Am
VERT POS	R8	Vertical Amplifier

c. Adjust level at Signal Generator for a 7-cm display. Center display with TUNE.

d. Turn BASE LINE CLIPPER maximum cw. At least the bottom 2 cm of the display should be blanked.

5-12. FOCUS CONTROL.

5-13. The FOCUS control is within specifications if focus is obtained somewhere within -90° and +90° of FOCUS travel where 0° is defined as the position the control has with its white arrow vertical.

5-14. VERTICAL DISPLAY ACCURACY CHECK.

5-15. EQUIPMENT REQUIRED

Ref No.	
11*	UHF Sig [illegible]
	8551 RF [illegible]
H**	Cable [illegible] (11500A

*Table 5-1 [illegible]

5-16. PRELIMINARY [illegible] turned on (see Figure [illegible] any other frequency [illegible] set

SPECTRUM WI [illegible]
SWEEP TIME
I.F. BANDWID [illegible]

Table 5-5. Chassis Parts Locater

Circuit Desig	Name	Location (Fig. No.) Photograph	Schematic
A1	I. F. GAIN (DB) Switch Assy	5-11	5-20
A2	RF Circuit Assy	5-11	5-24, 5-27
A3	100KC Bandpass Filter	under A9 board	5-24
A3L1	100KC Bandwidth Adj	5-10	5-24
A4S1	I. F. BANDWIDTH Switch	5-10	5-38
A5	100KC Bandpass Filter	under A9 board	5-24
A5L1	100KC Bandwidth Adj	5-10	5-24
A6	Sweep & Horizontal Amplifier Assy	5-10	5-33
A7	Vertical Amplifier Assy	5-11	5-29
A8	HV Power Supply Assy	5-10	5-35
A9	LV Power Supply Assy	5-10	5-37
A10R1	VERNIER (Sweep Time Switch)	5-11	5-33
A10S1	SWEEP TIME Switch Assy	5-11	5-33
A11	VERT DISPLAY Switch Assy	5-10	5-27
A12	Bandpass Filter Assy	5-10	5-20
C1	p/o Line-input filter	on inside of rear panel	5-37
C3	+100V supply filter	5-10	5-37
C4	-24V supply filter	5-10	5-37
C5	-24V supply filter	5-10	5-37
C6	Hold-Sweep-On Capacitor; on S3	5-10	5-33
C7	+15V supply filter	on inside of rear panel	5-37
C8	-15V supply filter	on inside of rear panel	5-37
L1	p/o Line-input filter	on inside of rear panel	5-37
L2	p/o Line-input filter	on inside of rear panel	5-37
L3	Couples TRACE ALIGN to CRT	on inside of CRT shield; see Figure 5-17	5-35
L4	p/o 24V filter	on side of A2 casting; see Figure 5-26C	5-37
Q1	Drives Step-up Xfmr A8T1	5-10, 5-11	5-35
Q2	Drives Step-up Xfmr A8T1	5-10, 5-11	5-35
Q3	LV Series Regulator	5-10	5-37
Q4	LV Series Regulator	5-10	5-37
Q5	LV Series Regulator	5-10	5-37
Q6	LV Series Regulator	5-10	5-37
R1	INTENSITY control	5-11	5-35
R2	Int Level Adj	5-10	5-35
R3	Astig Adj	5-10, 5-11	5-35
R4	FOCUS control	5-10	5-35
R5	TRACE ALIGN	5-10	5-35
R6	Isolation for Vert Ampl A7	on inside of rear panel	5-29
R7	BASE LINE CLIPPER	5-11	5-29
R8	VERT POS	5-11	5-29

Table 5-5. Chassis Parts Locater (cont'd)

Circuit Desig	Name	Location (Fig. No.)	
		Photograph	Schematic
R9	HORIZ POS	5-11	5-33
R10	I. F. VERNIER	5-11	5-37
R11	p/o +15V filter	on inside of rear panel	5-37
R12	p/o -15V filter	on inside of rear panel	5-37
S1	115/230 slide switch	under left cover plate	5-37
S2	SYNC switch	5-10	5-33
S3	SINGLE SWEEP switch	5-10	5-33
T1	Line Transformer	5-10	5-37
V1	CRT	5-10	5-35
W1	20-Mc I. F. input	5-10	5-20
W2	From Horizontal Amplifier to CRT (D1, D2)	5-10	5-33
W3	From Horizontal Amplifier to SWEEP OUTPUT	5-11	5-33
W4	CRT Post Accelerator lead; from HV Supply A8 to CRT V1	5-10	5-37

Table 5-6. Operational Checks

Note: Operational Checks are made with 851 connected to the 8551.

Par. Ref	Control Under Check	Procedure	Proper Performance
5-10	INTENSITY	LINE . . . . . ON INTENSITY . . . max cw Turn SWEEP TIME through range watching for retrace. INTENSITY . . . max ccw	No retrace at any SWEEP TIME setting No trace visible
5-11	BASE LINE CLIPPER	Perform initial turn-on (Fig. 3-3), 1 Gc input I. F. GAIN . . . 70 Adjust signal level for 7.0 cm display Set BASE LINE CLIPPER . max cw	At least bottom 2 cm of display should blank
5-12	FOCUS	Set FOCUS with white arrow vertical; this is 0°. Set FOCUS to -90°, then to +90°	Focus should be obtained between -90° and +90°.

Table 5-7. Performance Check Test Card, 851B

Ref	Procedure		Min	Act.	Max
5-14	**1. VERTICAL DISPLAY ACCURACY:**				
	a. Equipment Required: Stable Sig Gen (8614A) 8551 RF Section				
	b. SPECTRUM WIDTH . . 1 Mc/cm SWEEP TIME. . . . . 3 ms/cm I. F. BANDWIDTH . . . AUTO SELECT				
	c. Perform initial turn-on (Fig. 3-3), 1 Gc input				
5-17	**Linear:** ±3% of full scale				
	a. VERT DISPLAY . . . . LIN Inner I. F. GAIN . . . . 10 Outer I. F. GAIN . . . . for low-noise base-line trace (about 50)				
	b. Align trace base exactly w/graticule base line.				
	c. Adjust ATTENUATOR (DB) and output of Sig Gen for 7.0 cm display.				
	d. Set Inner I. F. GAIN to .4				
		-6 db cm	3.3	_____	3.7
5-18	**Square:** ±5% of full scale				
	a. VERT DISPLAY . . . . SQ Inner I. F. GAIN . . . . 10 Outer I. F. GAIN . . . . for low-noise base-line trace				
	b. Align trace base exactly w/graticule base line.				
	c. Adjust ATTENUATOR (DB) and output of Sig Gen for 7.0 cm display.				
	d. Set Inner I. F. GAIN to 7				
		-3 db cm	3.15	_____	3.85
5-19	**Logarithmic:** ±2 db				
	a. VERT DISPLAY . . . . LOG Inner I. F. GAIN . . . . 0 Outer I. F. GAIN 70				
	b. Adjust Sig Gen and ATTENUATOR (DB) for 7.0-cm display.				
	c. I. F. GAIN 60	cm	5.8	_____	6.2
	d. Adjust input sig level for 6.0 cm I. F. GAIN 50	cm	4.8	_____	5.2
	e. Input sig level for 5.0 cm I. F. GAIN 40	cm	3.8	_____	4.2
	f. Input sig level for 4.0 cm I. F. GAIN 30	cm	2.8	_____	3.2
	g. Input sig level for 3.0 cm I. F. GAIN 20	cm	1.8	_____	2.2
	h. Input sig level for 2.0 cm I. F. GAIN 10	cm	0.8	_____	1.2
	i. I. F. GAIN outer control. 10 I. F. GAIN inner control. 10 Sig Gen . . . . . for 2.0-cm display				
	j. I. F. GAIN outer control. 0	cm	0.8	_____	1.2

Table 5-7. Performance Check Test Card, 851B (cont'd)

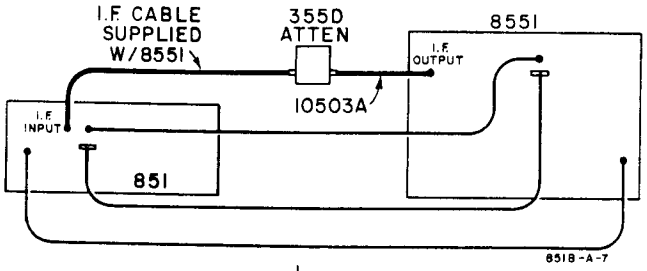
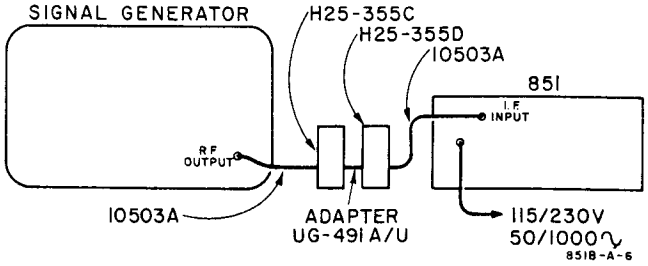
Ref	Procedure		Min	Act.	Max
	2. I.F. BANDWIDTH ACCURACY: Individual bandwidths are calibrated within ±20%. Bandwidth repeatability and stability typically better than ±3%.				
	Equipment Required: VHF Attenuator (355D) Cable term. w/BNC males (10503A) 8551 RF Section				
5-22	1MC, 100KC, and 10KC Bandwidths				
	a. Find 2-Gc BWO signal: see Paragraphs 5-92 thru 5-95.				
	b. SWEEP TIME . . . . . 3 ms/cm				
	c. I. F. BANDWIDTH . . . 1 MC SPECTRUM WIDTH . . 1 Mc/cm				
	d. Adjust VHF Atten and I. F. GAIN for 7.0-cm display.				
	e. Read display at 5.0 cm.	cm	0.8	____	1.2
	f. I. F. BANDWIDTH . . . 100KC SPECTRUM WIDTH . . 100 Kc/cm				
	g. Adjust for 7.0-cm display, read at 5.0 cm.	cm	0.8	____	1.2
	h. I. F. BANDWIDTH . . . 10KC SPECTRUM WIDTH . . 10 Kc/cm				
	i. Adjust for 7.0-cm display, read at 5.0 cm.	cm	0.8	____	1.2
	j. Return to each setting of I. F. BANDWIDTH, and note bandwidth at 5.0 cm.				
	k. Each should be within ±3% of recorded bandwidth.				
	Maximums	cm	0.77	____	1.23
5-23	3KC and 1KC Bandwidths				
	a. Calibrate SPECTRUM WIDTH: see Paragraph 5-98.				
	b. Set SPECTRUM WIDTH to 10 Kc/cm (by calibration, scale actually is 1 Kc/cm)				
	c. 3KC (1) I. F. BANDWIDTH . 3KC SWEEP TIME . . . 3 ms/cm (2) Adjust I. F. GAIN and Ext Atten for 7.0-cm display, read at 5.0 cm.	cm	2.4	____	3.6
	(3) Switch I. F. BANDWIDTH to any other setting, then back to 3KC; bandwidth should be within ±3% of that noted in step (2).				
	Maximums	cm	2.31	____	3.69
	d. 1KC (1) I. F. BANDWIDTH. . 1KC SWEEP TIME . . . 10 ms/cm (2) Adjust Atten for 7.0-cm display, read at 5.0 cm.	cm	0.8	____	1.2
	(3) Switch I. F. BANDWIDTH to any other setting, then back to 1KC; bandwidth should be within ±3% of that noted in step (2).				
	Maximums	cm	0.77	____	1.23

Table 5-7. Performance Check Test Card, 851B (cont'd)

Ref	Procedure		Min	Act.	Max
	3. I.F.INPUT SENSITIVITY: Input required* for 6-cm vertical display				
	Bandwidth / Limits (dbm): 1 Mc: -62 to -53; 100 Kc: -75 to -60; 10 Kc: -95 to -80; 3 Kc: -95 to -80; 1 Kc: -86 to -71				
	*With I. F. GAIN at 80 and I. F. VERNIER full ccw.				
	a. Equipment Required: Sig Gen w/calibrated power output (606A); Cable term. w/BNC males (10503A)				
5-26	b. Connect 851 to 115/230V 60/1000 cps.				
	c. Set Sig Gen for 20 Mc; connect to 851 I. F. INPUT.				
	d. I. F. GAIN . . . . . 70 + 10 I. F. VERNIER . . . . fully ccw I. F. BANDWIDTH . . . 1MC				
	e. Set Sig Gen output for 6.0 cm 851 display.				
	f. Read output at Sig Gen, taking into consideration loss through input cable	dbm	-62	_____	-53
	g. Perform steps e and f for other I. F. BANDWIDTH settings.				
	100KC	dbm	-75	_____	-60
	10KC		-95	_____	-80
	3KC		-95	_____	-80
	1KC		-86	_____	-71
	4. I.F.GAIN SET ACCURACY: 70-db section: ±0.5 db; 10-db section: ±0.1 db				
	a. Equipment Required: Precision 10-db/step Attenuator (hp H25-355D); Precision 1-db/step Attenuator (hp H25-355C); Signal Generator (606A); Adapter, BNC m-to-m (UG-491A/U); 2 - coax cables term. w/BNC males (10503A)				

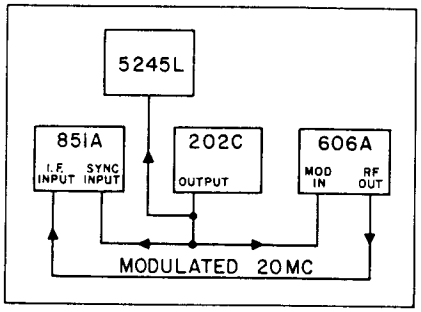


5-29	b. Set Sig Gen for 20 Mc.				

Table 5-7. Performance Check Test Card, 851B (cont'd)

Ref	Procedure		Min	Act.	Max
	4. I. F. GAIN SET ACCURACY (cont'd):				
	c. Set I. F. GAIN inner control . 0 I. F. GAIN outer control . 0 I. F. BANDWIDTH . . . 100KC SYNC . . . . . LINE SWEEP TIME . . . . . 3 MILLISEC/CM VERT DISPLAY . . . . SQ				
	d. Connect 851 to 115/230V source.				
	e. Set External Attens for 0.				
	f. Adjust Sig Gen for 6.0-cm 851 display.				
5-30a	g. Set External Attenuator for 10-db loss, I. F. GAIN (DB) to 10.	cm	5.2	_____	6.8
	h. If necessary, adjust Sig Gen for 6.0-cm 851 display.				
	i. Other I. F. GAIN positions; after each set of settings is changed, if necessary adjust Sig Gen for 6.0-cm 851 display.				
	Ext Atten / I. F. GAIN: 20 / 20	cm	5.2	_____	6.8
	30 / 30		5.2	_____	6.8
	40 / 40		5.2	_____	6.8
	50 / 50		5.2	_____	6.8
	60 / 60		5.2	_____	6.8
	70 / 70		5.2	_____	6.8
	j. Set I. F. GAIN inner and outer controls to 0, and External Attenuators to 0.				
	k. Adjust Sig Gen for 6.0-cm 851 display.				
5-30b	m. Set External Atten for 1-db loss, I. F. GAIN inner control to 1.	cm	5.8	_____	6.2
	n. If necessary, adjust Sig Gen for 6.0-cm 851 display.				
	p. Other I. F. GAIN positions; after each set of settings is changed, if necessary adjust Sig Gen for 6.0 cm 851 display.				
	Ext Atten / I. F. GAIN: 2 / 2	cm	5.8	_____	6.2
	3 / 3		5.8	_____	6.2
	4 / 4		5.8	_____	6.2
	5 / 5		5.8	_____	6.2
	6 / 6		5.8	_____	6.2
	7 / 7		5.8	_____	6.2
	8 / 8		5.8	_____	6.2
	9 / 9		5.8	_____	6.2
	10 / 10		5.8	_____	6.2

Table 5-7. Performance Check Test Card, 851B (cont'd)

Ref	Procedure	Min	Act.	Max
	5. SWEEP RATE ACCURACY: ±3%			
	a. Equipment Required: Electronic Counter (5245L) LF Oscillator (202C) Signal Generator (606A) Cable term. w/BNC male, banana plug (11001A) Cable term. w/BNC males (10503A)			
				
5-34	b. SWEEP TIME VERNIER . . . CAL I. F. BANDWIDTH . . . . . 1MC SYNC . . . . . EXT			
	c. LF Oscillator . . . . . about 3 volts Counter . . . . . 10 PERIOD AVERAGE Sig Gen . . . . . 20 Mc Output . . . . . -20 dbm MOD SELECT . . . . . EXT DC MOD AMPLITUDE . . . . . fully cw			
	d. SWEEP TIME . . . . . 3 ms/cm LF Osc . . . . . 333 cps (reading of 30 ms on Counter)			
	e. Note number cycles displayed. cycles	9.7	____	10.3
	f. For other sweep times:			

LF Osc set for cps	*Counter Reading	SWEEP TIME Setting				
100	100 ms	10 ms/cm	cycles	9.7	____	10.3
33.3	300 ms	30 ms/cm		9.7	____	10.3
10	1 sec	0.1 sec/cm		9.7	____	10.3
3.33	3 sec	0.3 sec/cm		9.7	____	10.3
1	10 sec	1 sec/cm		9.7	____	10.3
* Set for 10 Period Average						

5-17. LINEAR.

Accuracy Specification: ±3% of full scale

a. Set VERT DISPLAY to LIN, inner I. F. GAIN control to 10.

b. Adjust I. F. GAIN outer control for low-noise base-line trace (set to about 50).

c. Adjust VERT POS and TRACE ALIGN to align trace base exactly with graticule base line.

d. Adjust 8551 ATTENUATOR (DB) and Signal Generator output for 7.0-cm 851 display.

e. Set inner I. F. GAIN control to 4 (attenuate 6 db). Display should be no higher than 3.7 cm and no lower than 3.3 cm.

5-18. SQUARE.

Accuracy Specification: ±5% of full scale

a. Set VERT DISPLAY to SQ, inner I. F. GAIN control to 10.

b. Adjust I. F. GAIN outer control for low-noise base-line trace, bottom of which should coincide with first horizontal axis.

c. Adjust ATTENUATOR (DB) and Signal Generator output for 7.0-cm 851 display.

d. Set inner I. F. GAIN control to 7 (attenuate 3 db). Display should be no higher than 3.85 cm and no lower than 3.15 cm.

5-19. LOG.

Accuracy Specification: ±2 db

a. Set VERT DISPLAY to LOG, I. F. GAIN to 70+0.

b. Adjust 8551 ATTENUATOR (DB) and level at Signal Generator for 7.0-cm 851 display.

c. Set I. F. GAIN outer control to 60. Display should be within 5.8 to 6.2 cm.

d. If display does not coincide exactly with 6.0-cm graticule line, at Signal Generator readjust signal level for coincidence.

e. Proceed in same manner for other I. F. GAIN positions; see Table 5-8. If necessary, readjust signal level for trace coincidence with graticule line.

Table 5-8. VERT DISPLAY Accuracy Check

Set Display to (cm)	I. F. GAIN Setting		VERT DISPLAY Limits (cm)
	From	To	
7.0	70	60	5.8 to 6.2
6.0	60	50	4.8 to 5.2
5.0	50	40	3.8 to 4.2
4.0	40	30	2.8 to 3.2
3.0	30	20	1.8 to 2.2
2.0	20	10	0.8 to 1.2

f. With I. F. GAIN outer control at 10, set inner control to 10, and adjust level at Signal Generator for 851 2.0-cm display. Set outer control to 0. Display should be within 0.8 to 1.2.

5-20. I.F. BANDWIDTH ACCURACY CHECK.

Specification: Individual bandwidths are calibrated within ±20%. Bandwidth repeatability and stability typically better than ±3%.

5-21. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
10*	VHF Attenuator	1
D**	Shielded coax cable term. with BNC males (10503A)	1
	8551 RF Section	

*Table 5-1 **Table 5-2

5-22. 1MC, 100KC, AND 10KC BANDWIDTHS.

a. Connect Attenuator 355D between 851 and 8551, and find 2-Gc BWO signal; see Paragraphs 5-96 through 5-100.

b. Check bandwidths as indicated in Table 5-9, in each case recording actual bandwidth in cm.

c. Switch to any other setting of I. F. BANDWIDTH, then back to setting for bandwidth under test. Bandwidth should be within ±3% of recorded bandwidth (no < 0.77, no > 1.23 cm).

Table 5-9. I. F. Bandwidth Accuracy Checks (1MC, 100KC, 10KC)

Settings			Adjust Atten* for Display of	Read Display at	Spec Limits, BW (cm)	Record Actual BW (cm)
I. F. BW	SPECT WIDTH	SWEEP TIME				
1MC	1 Mc/cm	3 ms/cm	7.0 cm	5.0 cm	0.8 - 1.2	
100KC	100 Kc/cm	3 ms/cm	7.0 cm	5.0 cm	0.8 - 1.2	
10KC	10 Kc/cm	3 ms/cm	7.0 cm	5.0 cm	0.8 - 1.2	

*I. F. GAIN (DB) and external Attenuator (355D)

Table 5-10. I. F. Bandwidth Accuracy Checks, 3KC and 1KC

Settings			Adjust Atten** for Display of	Read Display at	Spec Limits, BW (cm)	Record Actual BW (cm)
I. F. BW	SPECT WIDTH	SWEEP TIME				
3KC	10* Kc/cm	3 ms/cm	7.0 cm	5.0 cm	2.4 - 3.6	
1KC	10* Kc/cm	10 ms/cm	7.0 cm	5.0 cm	0.8 - 1.2	

*Calibrated to 1 Kc/cm

**I. F. GAIN (DB) and External Attenuator (355D)

5-23. 3KC AND 1KC BANDWIDTHS.

a. Calibrate SPECTRUM WIDTH to obtain increased resolution; see Paragraph 5-103.

b. Check as indicated in Table 5-10.

c. Switch to any other setting of I. F. BANDWIDTH, then back to setting for bandwidth under test.

At 3KC, bandwidth should be between 2.31 and 3.69
At 1KC, bandwidth should be between 0.77 and 1.23

5-24. I.F.INPUT SENSITIVITY CHECK.

Specification - Input Required* for 6-cm Vertical Display

1-Mc bandwidth	-62 to -53 dbm
100-Kc bandwidth	-75 to -60 dbm
10-Kc bandwidth	-95 to -80 dbm
3-Kc bandwidth	-95 to -80 dbm
1-Kc bandwidth	-86 to -71 dbm

*With I. F. GAIN at 80 and I. F. VERNIER full counterclockwise

5-25. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
9*	Signal Generator set for 20 Mc; Generator must have calibrated power output (606A)	1
D**	Shielded coax term. with BNC males (10503A)	1

*Table 5-1 **Table 5-2

5-26. PROCEDURE.

a. Connect Signal Generator to I. F. INPUT on 851 rear panel. Check Line Switch 115/230 is set for voltage of power source, and connect 851 directly to 115/230V power source.

b. Set 851:
I. F. GAIN (DB) . . . . . 70 + 10
I. F. VERNIER . . . . . fully ccw
I. F. BANDWIDTH 1MC

c. At Signal Generator, adjust for 6.0 cm display on 851.

d. At Signal Generator, read output signal level, and take into consideration loss through input cable. Limits are given in Table 5-11.

e. Perform steps c and d at other settings of I. F. BANDWIDTH.

Table 5-11. I. F. Input Sensitivity Check

I. F. BANDWIDTH Setting	Input Signal Level Limits* (dbm)
1MC	-62 to -53
100KC	-75 to -60
10KC	-95 to -80
3KC	-95 to -80
1KC	-86 to -71

*For 6-cm deflection with I. F. GAIN at 80 db and I. F. VERNIER full counterclockwise

5-27. I.F.GAIN SET ACCURACY CHECK.

Specification - 70-db section: ±0.5 db
10-db section: ±0.1 db

5-28. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
12*	Precision 10-db/step Attenuator (H25-355D)	1
13*	Precision 1-db/step Attenuator (H25-355C)	1
9*	Signal Generator (606A)	1
D**	Coax cable term. w/BNC males (10503A)	2
J**	Adapter, BNC male-to-male (UG-491A/U)	1

*Table 5-1 **Table 5-2

5-29. SETUP. Accuracy of I. F. input attenuator I. F. GAIN (DB) is excellent and therefore cannot be checked

without special equipment of exceptional accuracy. The H25-355C and H25-355D are calibrated at 20 Mc to give required accuracy.

a. Set Signal Generator for 20 Mc.

b. Check that 851 115/230V Line Switch is set for voltage of power source, and connect 851 directly to 115/230V 50-1000 cps source.

c. Set 851:
I. F. GAIN inner control 0
I. F. GAIN outer control 0
I. F. BANDWIDTH 100KC
SYNC . . . . . LINE
SWEEP TIME . . . . . 3 MILLISEC/CM
VERT DISPLAY . . . . . SQ

d. Connect H25-355D to H25-355C via Adapter UG-491A/U. Set both External Attenuators for 0.

e. Connect one Attenuator to Signal Generator RF Output and other to I. F. INPUT on 851 rear panel.

5-30. PROCEDURE.

a. I. F. GAIN Outer Control.

(1) With External Attenuator and I. F. GAIN outer control both set for 0, adjust level at Signal Generator for 6.0-cm trace on 851 CRT.

(2) Set External Attenuator for 10-db loss; set I. F. GAIN outer control to 10.
Trace should be within 5.2 and 6.8 cm.
Note: With signal reference at 6.0 cm, ±0.8 cm is approximately ±0.5 db.

(3) If necessary, adjust level at Signal Generator to return reference trace to 6.0 cm.

(4) Check other I. F. GAIN positions in same manner, turning both External Attenuator and I. F. GAIN in 10-db steps to 70 db.
At each 10-db change, trace should be within 5.2 and 6.8 cm.
Note: If necessary, readjust signal level at 10-db change to maintain reference at 6.0 cm.

b. I. F. GAIN Inner Control.

(1) Set I. F. GAIN inner control 0
I. F. GAIN outer control 0
External Attenuator 0
Signal Generator . . . for 6.0 cm trace on 851 CRT

(2) Set External Attenuator for 1-db loss; set I. F. GAIN inner control to 1.
Trace should be within 5.8 and 6.2.
Note: With signal reference at 6.0 cm, ±0.2 cm is approximately ±0.1 db.

(3) If necessary, adjust level at Signal Generator to return reference trace to 6.0 cm.

(4) Check other I. F. GAIN inner control positions in same manner, maintaining reference trace at 6.0 cm.

At each 1-db change, trace should be within 5.8 and 6.2 cm.

5-31. SWEEP RATE ACCURACY CHECK.

Specification - Sweep Rate Accuracy: ±3%

5-32. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
7*	Electronic Counter (5245L)	1
8*	Low-Frequency Oscillator (202C)	1
9*	Signal Generator (606A)	1
C**	Shielded cable, BNC male to banana plug (11001A)	1
D**	Shielded cable, term. with BNC males (10503A)	1
*Table 5-1	**Table 5-2	

5-33. SETUP. Connect as indicated in Figure 5-3, except that 851 can be connected directly to 115/230V, 50/1000-cycle source.

5-34. PROCEDURE. Instructions assume use of equipments shown in Figure 5-3.

a. Set 851:
SWEEP TIME VERNIER . . . . . CAL
I. F. BANDWIDTH 1MC
SYNC . . . . . EXT

b. Set Low-Frequency Oscillator for output of about 3 volts (AMPLITUDE control at about 90).

c. Set Counter FUNCTION selector for 10 PERIOD AVERAGE.

d. Set Signal Generator controls:
RANGE, FREQUENCY . . . for 20 Mc output
ATTENUATOR, VERNIER for -20 dbm output
MODULATION SELECTOR . . . . . EXT DC
MODULATION AMPLITUDE . . . . fully cw

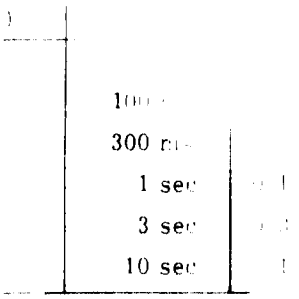
e. With equipments connected as shown in Figure 5-3, output of Oscillator 202C, monitored by Counter, is modulating the 20-Mc output of the Signal Generator. Output of Signal Generator is displayed on 851 CRT.

f. To check sweep-rate accuracy specification:

(1) Set SWEEP TIME to 3 MILLISEC/CM.

(2) Adjust Oscillator 202C for output of precisely 333 cps (reading of 30 ms with Counter set for 10 period average).
Sweep rate is within specifications if 9.7 - 10.3 cycles appear on display.
Note: Period of 333-cycle signal is 0.003 second.

g. Check other SWEEP TIME positions, using procedure indicated in Table 5-12.
With settings as specified in Table 5-12, sweep rate is within specifications if 9.7 - 10.3 cycles appear on display.



Table

Ref	Seq			
INSTRUMENT OFF				
	1	Mec		
5-39	2	Pre		
INSTRUMENT ON				
	3			23
5-40		LV POW		
	4		vdc	-14
			vdc	
			p-p	
	5		vdc	-14
			vdc	
			p-p	
	6		vdc	-92.5
			vdc	
			mv p-p	
		HV POW		
	7		vdc	2330

Table 5-13. 851B Check and Adjustment Test Card (cont'd)

Ref	Seq	Operation		Record Min	Record Act.	Record Max
		HV POWER SUPPLY (cont'd)				
	8	INTENSITY & FOCUS cw cathode V change	vdc			60
	9	post accelerator V	vdc	4750	_____	5450
5-46	10	FOCUS, Astigmatism, & Pattern Shape adjusts produce sharp spot FOCUS produces sharp spot at all INTENSITY levels				
		HORIZONTAL AMPLIFIER				
5-49	11	Adj TRACE ALIGN				
	12	Calibration: cw rotation of HORIZ POS moves trace right - center trace Adj Horiz Gain A6R54 for 10-cm deflection HORIZ POS trace movement - each direction	cm	0.5	_____	1.5
5-51		TIME BASE				
	13	Sweep Calibration: SWEEP TIME VERNIER - CAL				

MOD FREQ (cps)	10 PERIOD MEAS	SWEEP TIME	ADJ
333	30 ms	3 ms	A6R29
100	100 ms	10 ms	A6R30
33.3	300 ms	30 ms	A6R31
10	1 sec	.1 sec	A6R32
3.33	3 sec	.3 sec	A6R33
1	10 sec	1 sec	A6R34

5-54e	14	Sweep Linearity: SWEEP TIME: 3 ms/cm Distance between successive positive mod peaks	cm	0.8	_____	1.2
5-55	15	SWEEP TIME VERNIER: Mod frequency: 100 cps SWEEP TIME: 3 ms/cm SWEEP TIME VERNIER: full ccw 1-cycle waveform width	cm		_____	1.0
5-58	16	SINGLE SWEEP & sweep amplitude	V p-p	9.7	_____	10.3
5-61		SYNC & OUTPUT CHECKS				
	17	EXT SYNC: 1 cps - 5 Kc				
	18	VERT OUTPUT check				
	19	HORIZ OUTPUT check				
	20	LINE sync check				
	21	BASE LINE CLIPPER blanks at least lower 2 cm of trace				
5-69	22	CRT CHECKS				
		Check TRACE ALIGN				
	23	Pattern distortion & resolution: Adj Pattern Shape A7R22 for minimum average distortion on edges of 20 Kc pattern				
		Check 1 Kc pattern for uniform focus at normal intensity				
	24	Blanking: no retrace all sweep speeds				

Table 5-13. 851B Cneck and Adjustment Test Card (cont'd)

Ref	Seq	Operation		Record Min	Act.	Max
5-76	25	VERTICAL AMPLIFIER				
		Calibration:				
		a. cw rotation of VERT POS moves trace upward				
		b. Align trace with base line - no input				
5-80		c. Set 20-Mc Sig Gen for 4.0 ±0.1 vdc detected input to Vert Ampl				
		d. Adjust A7R15 for 6.0 cm defl				
		e. Repeat steps b & d until both conditions are met.				
5-81	26	Video Bandwidth:				
		I. F. BANDWIDTH: 1MC				
		Set 50 Kc Vertical Amplifier input for 7.0 cm defl				
		Increase freq to 1.2 Mc, same input V				
		Vert defl	cm	5.0	_____	
		Other I. F. BANDWIDTH positions				
		1 Kc ref				
		100KC I. F. BANDWIDTH	Kc	160	_____	240
		10KC		32	_____	48
		3KC		9.6	_____	14.4
		1KC		3.2	_____	4.8
		I. F. BANDWIDTH VERT DISPLAY - LIN				
5-82	27	1 Mc Alignment:				
		Adj Detect. Tune A2A7T1				
		Tune Imped Adj A2A6L11				
		Preset A12C1, A12C3, A12L2				
5-86	28	1MC BANDWIDTH check	Mc	1.4	_____	2.2
5-89	29	100 Kc Alignment:				
		Tune 100 Kc BW adj in A3 & A5				
		Tune Imped Adj A2A2L1				
5-90	30	100KC BANDWIDTH check:	Kc	80	_____	120
5-91	31	Final 1MC and 100KC Bandwidth Adjusts				
		Connect 851 to 8551				
		Perform 1-14, Fig. 3-3				
		SWEEP TIME . . . 3 ms/cm				
		I. F. BANDWIDTH . 1MC				
		Input signal - anywhere between 10 Mc and 5 Gc				
		Set SPECTRUM WIDTH . . . 1 Mc/cm				
		VERT DISPLAY. . . . . LOG				
		Check symmetry and if necessary readjust A12C1, A12C3, A12L1.				
		Set SPECTRUM WIDTH . . . 100 Kc/cm				
		I. F. BANDWIDTH 100KC				
		Check symmetry and if necessary readjust A12C1, C3, L2.				
5-91, e-j		Switch back and forth between LIN and LOG and between 1MC and 100KC I. F. BANDWIDTH readjusting as required for best compromise on amplitude and symmetry while keeping bandwidths within specifications.				
5-94 5-101	32	1-3-10 Kc Alignment:				
		SPECTRUM WIDTH . 10 Kc				
		I. F. BANDWIDTH . . 10 Kc				
		SWEEP TIME . . . . 3 ms/cm				

Table 5-13. 851B Check and Adjustment Test Card (cont'd)

Ref	Seq	Operation		Record Min	Act.	Max
		I. F. BANDWIDTH (cont'd)				
5-101		1-3-10 Kc Alignment (cont'd): If desired, remove RF Ckt Assy A2 cover. Preset Bal Adj A2A3C5 & A2A4C8 at 1/3 mesh. Tune 1-10 Kc BW Adj A2A3C4, A2A3C2, A2A4C5, & A2A4C9 for max BW Adj Imped Adj A2A3L3 and Freq Adj A2A4C7 for max defl Set I. F. GAIN for 7.0 cm display. Check bandwidth at 5.0 cm Readjust until bw at 5.0 cm vert defl is 1 cm	cm	1	_____	1
5-102	33	3KC & 1KC BANDWIDTH checks: See Calib, Paragraph 5-103.				
5-104		BW at 5.0 cm with 7.0 cm max defl 3KC 1KC Reinstall Assy A2 cover	cm	2.4 0.8	_____ _____	3.6 1.2
5-105	34	Recheck 10 Kc BW adj: SPECTRUM WIDTH - 10 Kc I. F. BANDWIDTH - 10 Kc BW at 5.0 cm with 7.0 cm max defl	cm	0.8	_____	1.2
5-107	35	AUTO SELECT CHECK Optimum BW is automatically selected For check see Paragraph 5-110 and Table 5-19				
5-111		I. F. SENSITIVITY I. F. GAIN - 80 db I. F. GAIN VERNIER - full cw				
5-114	36	Power input for 6-cm vert defl I. F. BW 1 Mc 100 Kc 10 Kc 3 Kc 1 Kc	dbm	-53 -60 -80 -80 -71	_____ _____ _____ _____ _____	-62 -75 -95 -95 -86
5-115	37	Noise Level I. F. BW 1 Mc 100 Kc 10 Kc 3 Kc 1 Kc			_____ _____ _____ _____ _____	0.45 0.45 0.45 0.45 0.45

Table 5-13. 851B Check and Adjustment Test Card (cont'd)

Ref	Seq	Operation	Record Min	Record Act.	Record Max
5-116		VERTICAL DISPLAY			
		I. F. GAIN - 20 db I. F. BW - 1 Mc			
5-117c	38	Check trace alignment			
5-118	39	LOG Display Adj: Adj input for 1 cm defl			
		Increase I. F. GAIN to 40 db Adj A11R13 for 3 cm defl			
		Increase I. F. GAIN to 60 db Adj A11R14 for 5 cm defl			
		Increase I. F. GAIN to 70 + 10 db Adj A11R20 for 7 cm defl			
		I. F. GAIN VERNIER - full cw Gain decrease: db Reset VERNIER full ccw	1	_____	
5-120	40	LOG Display Linearity: Decrease I. F. GAIN in 10-db steps Trace should decrease 1 cm/step Error at each cm div cm Repeat 40 for other I. F. bandwidths		_____	±0.2
5-122	41	SQ Display Adj: Adj input for 7.0 cm defl with 20 + 10 db I. F. GAIN Decrease I. F. GAIN 6 db Adj A11R2 for 1.75 cm defl			
5-123	42	SQ Display Linearity: I. F. GAIN		Vert Defl - cm	
		-3 db -6 db	3.15 1.40	_____ _____	3.85 2.10
		Repeat 42 for other I. F. BWs			
	43	LIN Display Linearity: I. F. GAIN		Vert Defl - cm	
		-6 db -12 db	3.29 1.54	_____ _____	3.71 1.96
		Repeat 43 for other I. F. BWs			
5-124		FINAL I. F. BANDWIDTH ADJUSTS (with 8551)			
5-127	44	Crystal Filter Balance: VERT DISPLAY - LOG			
		60-Mc input - 7-cm defl Tune A2A3C5 & A2A4C8 for best symmetrical display & best compromise:			

8551 SPECTRUM WIDTH	851 I. F. BANDWIDTH
300 Kc/cm	10 Kc
100 Kc/cm	3 Kc
30 Kc/cm	1 Kc

Table 5-13. 851B Check and Adjustment Test Card (cont'd)

Ref	Seq	Operation	Record Min	Record Act.	Record Max
		FINAL I. F. BANDWIDTH ADJUSTS (with 8551) (cont'd)			
5-128	45	1 Mc Bandpass Filter Adjustments: VERT DISPLAY - LIN SPECTRUM WIDTH - 1 Mc/cm I. F. BW - 100 Kc Center display on CRT I. F. BW - 1 Mc Adj 851 A12C1, A12C2, & 8551 A9A2L2 for symmetrical display and 1-Mc BW			
5-130		I. F. BW - 100 Kc Max ampl on CRT is at same freq as 1 Mc bandwidth			

5-37. CHECKS AND ADJUSTMENTS.

5-38. Procedures for checking and adjusting the 851B are provided in Paragraphs 5-39 through 5-130.

a. Most of the procedures call for the use of other equipment; only those instructions pertinent to the procedure are given -- for full operating instructions use the Manual supplied with the instrument.

b. Unless specified otherwise, the 851B is not connected to the 8551, but is powered separately. Procedures assume a 115-volt line.

c. Removal of cover plates is simple; instructions are given in Paragraph 5-6 and will not be referenced again.

d. When making a thorough check of the instrument, it is recommended that procedures be performed in the order presented.

5-39. PRELIMINARY ADJUSTMENT PROCEDURE.

a. Equipment Required.

Ref No.	Equipment	No.
3	Variable Transformer	1

b. Remove 851 top cover plate.

c. Set 115V/230V slide switch on rear panel to 115V.

d. Set front panel controls:

BASE LINE CLIPPER . . . . . max ccw
INTENSITY . . . . . max ccw
SWEEP TIME . . . . . 1 SEC/CM
SWEEP TIME VERNIER . . . . . max ccw
SYNC . . . . . INT
VERT DISPLAY . . . . . LIN
I. F. BANDWIDTH . . . . . 100 KC
I. F. GAIN . . . . . 30 DB

e. Set Int Level R2 max cw. (R2 is located to right of cathode-ray tube toward rear of instrument; see Figure 5-1.)

f. Set Variable Transformer to minimum. Connect 851 to power source through Variable Transformer, and increase Transformer voltage slowly to 115 volts.

5-40. LV POWER SUPPLY ADJUSTMENTS.

5-41. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
3*	Variable Transformer, set for 115V input	1
1*	Oscilloscope (130C)	1
2*	Digital DC Voltmeter (3440A)	1
A**	Shielded cable, banana plug to banana plug (11000A)	1
B**	Shielded cable, banana plug to alligator clips (11037A)	1

*Table 5-1 **Table 5-2

5-42. PROCEDURE.

a. Connect Digital Voltmeter and vertical input of Oscilloscope in parallel using shielded cables.

b. Locate Low-Voltage Power Supply Board A9 (see Figure 5-1).

(1) Make ground connection at - A9C6 (point Ⓐ, Figure 5-36).

(2) Measure and adjust the low-voltage power supplies in accordance with Table 5-14. (Normal resistances to ground are given for reference in Table 5-15.)

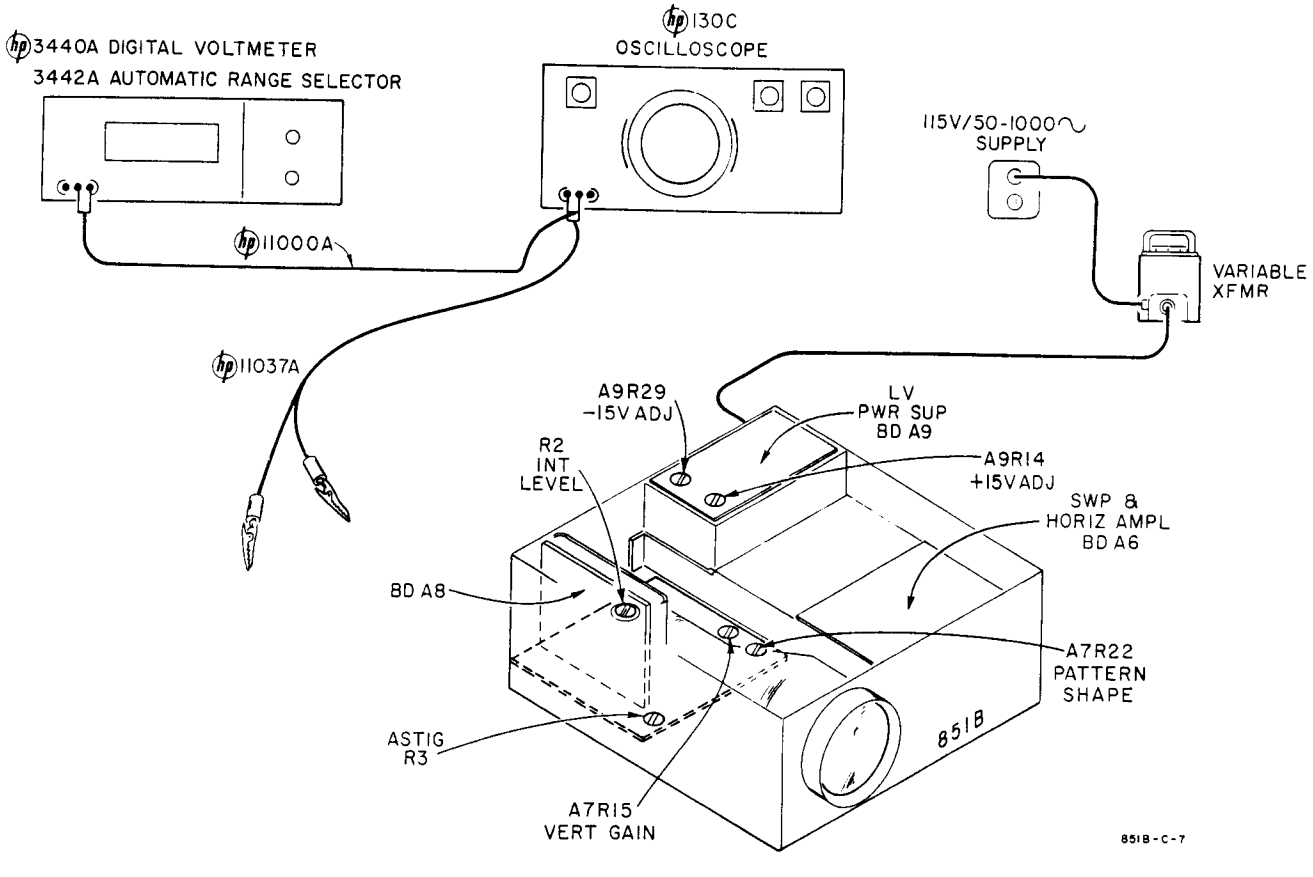


Figure 5-1. Measurement Setup, Check and Adjustment of LV Power Supply

Table 5-14. LV Power Supply Measurement Data

Supply	Meas Point	Ref Fig. 5-36	Adjust	115V Line (vdc)	103.5V to 126.5V Line	
					Reg (max Δ vdc)	Max Ripple (mv p/p)
+ 15vdc	+A9C6	(B)	A9R14	+15±0.1	±0.03	1.5
- 15vdc	-A9C10	(C)	A9R29	-15±0.1	±0.03	6.0
+100vdc	+A9C1	(D)		100±7.5	±3.0	75

Table 5-15. Resistances to Ground, LV Power Supply, Reference Data

Supply	Meas Point	Ref (Fig.5-36)	Normal Resistance* (ohms)
+15 vdc	+A9C6	(B)	> 300
-15 vdc	-A9C10	(C)	> 27
+100 vdc	+A9C1	(D)	> 9000

*As measured with electronic volt-ohmmeter such as hp 410B, 410C, or 412A

5-43. HV POWER SUPPLY CHECK.

5-44. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
3*	Variable Transformer, set for 115V input	1
4*	Clip-On DC Milliammeter (428B)	1
5*	DC Voltmeter (410C)	1
6*	DC Voltage Divider (11045A)	1

*Table 5-1

5-45. PROCEDURE.

a. Instrument Condition. Top cover plate, left side plate, and CRT protective cover (on rear of instrument) are removed.

b. Cathode Current.

(1) Wiring to CRT base is shown in Figure 5-2. Note gray wire designated (A); clip Milliammeter probe around gray conductor (A).

(2) Turn INTENSITY max cw, and adjust Int Level R2 (to right of CRT, see Figure 5-1) for 0.5 ma.

(3) Turn INTENSITY fully ccw, and check that beam is extinguished (no cathode current).

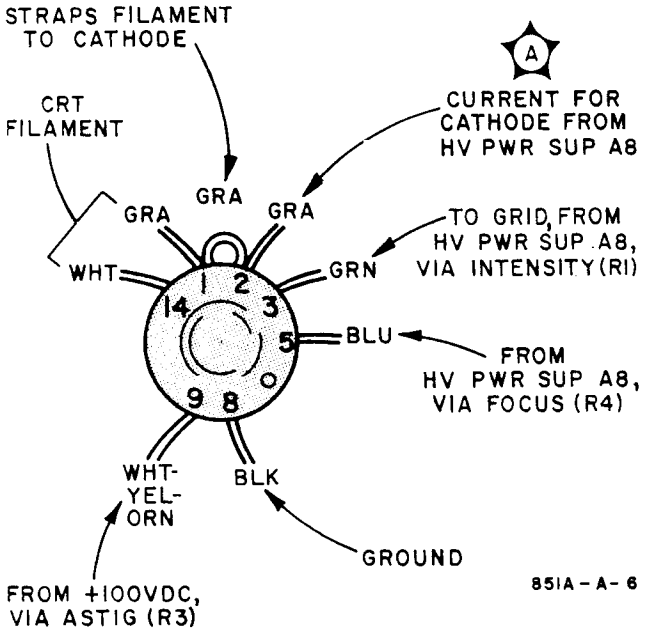


Figure 5-2. CRT Base as Seen from Rear, CRT Protective Cover Removed

c. Cathode and Post-Accelerator Voltages. Using a dc Voltmeter and Voltage-divider Probe, check as shown in Table 5-16. Location of A8 board is shown in Figure 5-1.

Table 5-16. HV Power Supply Voltages

Voltage Checked	Settings	Meas Point	Ref (Fig. 5-34)	Test Limits (vdc)
Cathode	INTENSITY, full ccw INTENSITY, full cw FOCUS, full cw	-A8C7	A	2500 ±190
Post Acceler	same	Junction A8R3, A8C4	11	
*The change in cathode voltage should not exceed 60 vdc.				

5-46. FOCUS CHECK AND ADJUSTMENT.

5-47. CHECK.

a. With the 851B connected to a source of power (either the Model 8551 or through a Variable Transformer set for 115V), adjust FOCUS for a sharp spot on the CRT.

b. Turn INTENSITY through its range and adjust FOCUS to maintain a sharp spot at all INTENSITY levels.

5-48. ADJUSTMENT. If a sharp spot is not obtained, adjust FOCUS, Astig adjust R3, and Pattern Shape adjust A7R22 for a sharp spot. Then check that a sharp spot can be obtained as INTENSITY is turned through its range. See Figure 5-1 for location of Astig adjust R3 and Pattern Shape adjust A7R22.

5-49. HORIZONTAL AMPLIFIER CHECKS AND ADJUSTMENTS.

5-50. CALIBRATION.

a. Adjust TRACE ALIGN so that horizontal trace is parallel to horizontal axis.

b. Rotate HORIZ POS (R9); trace should move to right. Adjust HORIZ POS to center trace on graticule.

c. Adjust Horiz Gain adjust A6R54 (see Figure 5-31) for 10 cm of horizontal deflection.

d. Turn front panel HORIZ POS adjust full cw and note how far trace moves, then turn HORIZ POS full ccw and note trace movement; trace should move at least 1.0 ±0.5 cm each direction.

e. Center trace.

5-51. SWEEP TIME CALIBRATION.

5-52. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
3*	Variable Transformer, set for 115V	1
7*	Electronic Counter (5245L)	1
8*	Low-Frequency Oscillator (202C)	1
9*	Signal Generator (606A)	1
C**	Shielded cable, BNC male to dual banana plug (11001A)	3
D**	Shielded cable, BNC male to BNC male (10503A)	1
*Table 5-1 **Table 5-2		

5-53. MEASUREMENT SETUP. Connect as indicated in Figure 5-3.

5-54. PROCEDURE. The following instructions assume use of equipment shown in Figure 5-3.

a. Set 851 controls:
SWEEP TIME VERNIER. . . . . CAL
I. F. BANDWIDTH . . . . . 1 MC
SYNC . . . . . EXT

b. Set Low-Frequency Oscillator for output of about 3 volts (AMPLITUDE control at about 90).

c. Set Counter FUNCTION selector for 10 PERIOD AVERAGE.

d. Set Signal Generator controls:
RANGE, FREQUENCY . . . . for 20 Mc output
ATTENUATOR, VERNIER . for -20 dbm output
MODULATION SELECTOR . . . . . .EXT DC
MODULATION AMPLITUDE . . . . . full cw

e. With equipments connected as shown in Figure 5-3, the output of Oscillator 202C, monitored by Counter, is modulating the 20-Mc output of the Signal

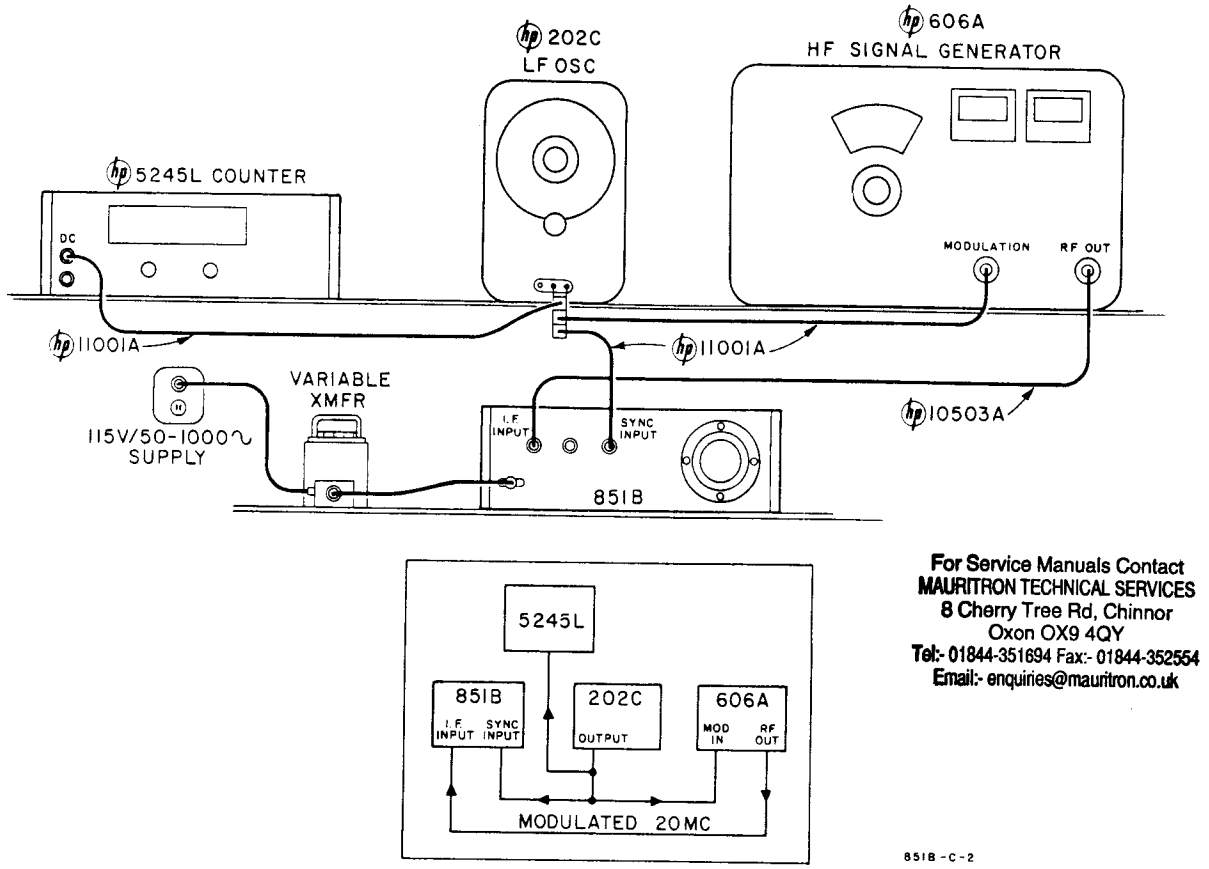


Figure 5-3. Measurement Setup, Sweep Calibration

Generator. Output of the Signal Generator is displayed on the 851 CRT. To check the linearity of the sweep generator output and to calibrate the 3 MILLISECOND/CM position of the 851 SWEEP TIME switch:

(1) Set SWEEP TIME to 3 MILLISEC/CM.

(2) Adjust Oscillator 202C for an output of precisely 333 cps (reading of 30 ms with counter set for 10 period average).

(3) Adjust A6R29 (see Figure 5-31) so modulation peaks are precisely aligned with graticule vertical lines. The distance between each successive modulation peak on the display should not exceed 1 ±0.2 cm. This checks sweep linearity; if linearity is good in one position of SWEEP TIME it will be good in all others.

f. Set SWEEP TIME to 10 MILLISEC/CM, and Oscillator output for precisely 100 cps. Adjust A6R30 to align the first and last modulation peak with the first and tenth vertical lines on graticule.

g. Follow the same procedure at other positions of SWEEP TIME, using data given in Table 5-17.

Table 5-17. Sweep Time Calibration

Mod Freq (cps)	Counter Reading*	SWEEP TIME Setting	851 Adjust	Fig. Ref
333	30 ms	3 MILLISEC/CM	A6R29	5-31
100	100 ms	10 MILLISEC/CM	A6R30	
33.3	300 ms	30 MILLISEC/CM	A6R31	
10	1 sec	.1 SEC/CM	A6R32	
3.33	3 sec	.3 SEC/CM	A6R33	
1	10 sec	1 SEC/CM	A6R34	

*For 10-period average

5-55. SWEEP TIME VERNIER CHECK.

5-56. SETUP. To check that the SWEEP TIME VERNIER has the proper range, use the setup used for SWEEP TIME calibration (see Paragraph 5-51 and Figure 5-3).

5-57. PROCEDURE.

a. Set SWEEP TIME. . . . . 3 MILLISEC/CM
SWEEP TIME VERNIER . . . . . CAL

b. Set Low-Frequency Oscillator for precisely 100 cps (Counter reading of 100 ms when set for 10 PERIOD AVERAGE).

c. Rotate SWEEP TIME VERNIER full ccw, and note period of one cycle as displayed on 851 CRT; width of cycle waveform should be less than 1.0 cm.

5-58. SINGLE SWEEP AND SWEEP AMPLITUDE CHECKS.

5-59. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
3*	Variable Transformer, set for 115V	1
2*	Digital Voltmeter (3440A)	1
C**	Shielded cable, dual banana plug to BNC male (11001A)	1

*Table 5-1 **Table 5-2

5-60. PROCEDURE.

a. On the 851, set
SWEEP TIME . . . . . 1 SEC/CM
SWEEP TIME VERNIER. . . . . ccw
SYNC . . . . . SINGLE SWEEP

b. Connect SWEEP OUTPUT (on rear of 851) to Digital Voltmeter. Note reading obtained.

c. Depress SINGLE SWEEP button on 851 front panel.

d. Note that single sweep is obtained, and note maximum positive voltage indicated by Voltmeter. Sweep amplitude should be 10.0 ±0.3 volts.

5-61. SYNCHRONIZATION & OUTPUT CHECKS.

5-62. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
3*	Variable Transformer set for 115V	1
1*	Oscilloscope (130C)	1
8*	Low-Frequency Oscillator (202C)	1
9*	Signal Generator (606A)	1
A**	Shielded cable, dual banana plug to dual banana plug (11000A)	1
C**	Shielded cable, BNC male to dual banana plug (11001A)	2
D**	Shielded cable, BNC male to BNC male (10503A)	1

*Table 5-1 **Table 5-2

5-63. MEASUREMENT SETUP. Similar to that shown in Figure 5-3 except that Oscilloscope replaces Counter, and is connected as noted in Paragraphs 5-65, 5-66, and 5-67.

5-64. EXTERNAL SYNC CHECK.

a. On 851, set SYNC to EXT.

b. Set Low-Frequency Oscillator for output of 6 volts peak-to-peak.

c. Set Signal Generator output attenuator to -20 dbm.

d. Vary Oscillator output frequency from 1 cps to 5 Kc and, changing 851 sweep time as required, observe signal displayed on 851. Signal displayed should be stable from 1 cps to 5 Kc.

5-65. VERTICAL OUTPUT CHECK.

a. Connect Oscilloscope to VERT OUTPUT on 851 rear panel.

b. Check that signal is displayed on Oscilloscope.

5-66. HORIZONTAL OUTPUT CHECK.

a. Connect Oscilloscope to HORIZ OUTPUT on 851 rear panel.

b. Check that signal is displayed on Oscilloscope.

5-67. LINE SYNC CHECK.

a. On 851, set SYNC to LINE.

b. Set Oscilloscope input for dc coupling, sync on line.

c. Connect 851 SWEEP OUTPUT to Oscilloscope. Display of sweep signal should remain in synchronization.

5-68. BASE LINE CLIPPER CHECK. Rotate BASE LINE CLIPPER full cw; trace on at least lower 2 cm of 851 CRT should blank.

Note

At high INTENSITY levels, it is normal for trace to defocus slightly when BASE LINE CLIPPER is set cw.

5-69. CRT CHECKS.

5-70. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
8*	Low-Frequency Oscillator (202C)	1
9*	Signal Generator (606A)	1
C**	Shielded cable, banana plug to BNC male (11001A)	2
D**	Shielded cable, BNC male to BNC male (10503A)	1

*Table 5-1 **Table 5-2

5-71. MEASUREMENT SETUP. Make connections between Low-Frequency Oscillator, Signal Generator, and 851 as indicated in Figure 5-3.

5-72. ALIGNMENT. Before starting to check the CRT, make sure horizontal trace is parallel to horizontal axis of graticule; if not, readjust TRACE ALIGN.

5-73. PATTERN DISTORTION AND RESOLUTION.

a. 100% modulate Signal Generator at 20 Kc using Low-Frequency Oscillator as modulating voltage source.

b. Set 851 I. F. GAIN for 6 cm of vertical deflection on 851 CRT.

Figure 5-4. Pin-cushioning and Barrelling Defined

c. Check pattern for excessive barrelling or pin-cushioning (see Figure 5-4); if present, adjust A7R22, Pattern Shape Adj on Vert Ampl Bd A7 (see Figure 5-1), for best compromise (minimum average distortion of horizontal and vertical edges of pattern).

d. Decrease Low-Frequency Oscillator output frequency to 1 Kc; at normal intensity, focus should be uniform throughout the 6 x 10 cm screen area.

5-74. BLANKING.

a. Set INTENSITY full cw.

b. Observe trace on all sweep speeds. No retrace should be seen.

5-75. VERTICAL AMPLIFIER CHECKS AND ADJUSTMENTS.

5-76. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
3*	Variable Transformer, set for 115V	1
2*	Voltmeter with automatic range finder (3440A & 3442A)	1
9*	Signal Generator (606A)	1
8*	Low-Frequency Oscillator (202C)	1
B**	Shielded cable, dual banana plug to alligator clips (11037A)	1
D**	Shielded cable, BNC male to BNC male (10503A)	1
E**	Adapter, BNC female to dual banana plug (10111A)	1
A**	Shielded cable term. w/dual banana plugs (11000A)	

*Table 5-1 **Table 5-2

5-77. VERTICAL CALIBRATION.

5-78. VERTICAL POSITION.

a. Rotate VERT POS adjust cw; trace should move upward.

b. With no input, align trace with base line of graticule.

5-79. CALIBRATION SETUP.

a. Turn instrument so it is resting on top plate. Remove bottom plate.

b. Measurement setup is shown in Figure 5-5. Connect Voltmeter (digital with automatic range finding capability) at feed-thru terminal (Video Out) at output of RF Circuit Assembly A2. This terminal projects through the casting that encloses Assembly A2, and is identified in Figure 5-6.

5-80. CALIBRATION PROCEDURE.

a. Set Signal Generator:
RANGE, FREQUENCY . . . for 20-Mc output
ATTENUATOR, VERNIER . for 4.0 ±0.1 vdc detected input to Vertical Amplifier (as read on Digital Voltmeter)

b. Adjust Vert Gain Adj A7R15 (see Figure 5-5) for 6.0 cm vertical deflection on CRT.

c. Disconnect Signal Generator; trace should return to graticule base line.

(1) If trace does not return to base line, again adjust VERT POS to align trace with base line.

(2) Then again perform calibration procedure (steps a, b, and c).

(3) Continue until requirements of both steps b and c are met.

Note

Since VERT POS and Vert Gain interact, it may be necessary to repeat adjustments several times.

5-81. VIDEO BANDWIDTH.

a. Disconnect coaxial lead at feed-thru terminal coming out of casting which houses RF Circuit Assembly A2. Connect Signal Generator to this coaxial lead (this lead is Vertical Amplifier Input Cable A2W6 and is identified in Figure 5-6).

b. Set 851 I. F. BANDWIDTH to 1 Mc.

c. Set Signal Generator:
RANGE, FREQUENCY. . . for 50 Kc output
ATTENUATOR . . . . . .3 VOLT range

d. Adjust Signal Generator output (use VERNIER on hp 606A) for 7.0 cm vertical deflection on 851 CRT, and note reading of Signal Generator output meter.

e. Increase frequency of Signal Generator output to 1.2 Mc, and adjust level of output to obtain same meter reading as was noted in step d.

f. Observe vertical deflection on 851 CRT. Vertical deflection should exceed 5.0 cm.

g. Replace Signal Generator with Low-Frequency Oscillator such as the hp 202C. Monitor amplitude of Oscillator output with an Oscilloscope.

h. Set 851 I. F. BANDWIDTH at 100KC.

(1) Set Oscillator for 1 Kc output, and adjust output level (use AMPLITUDE on 202C) for 7.0 cm of vertical deflection on 851 CRT. On monitoring Oscilloscope, note amplitude at which 7.0 cm deflection was obtained.

(2) Increase Oscillator output frequency until 851 CRT vertical deflection decreases to 5.0 cm.

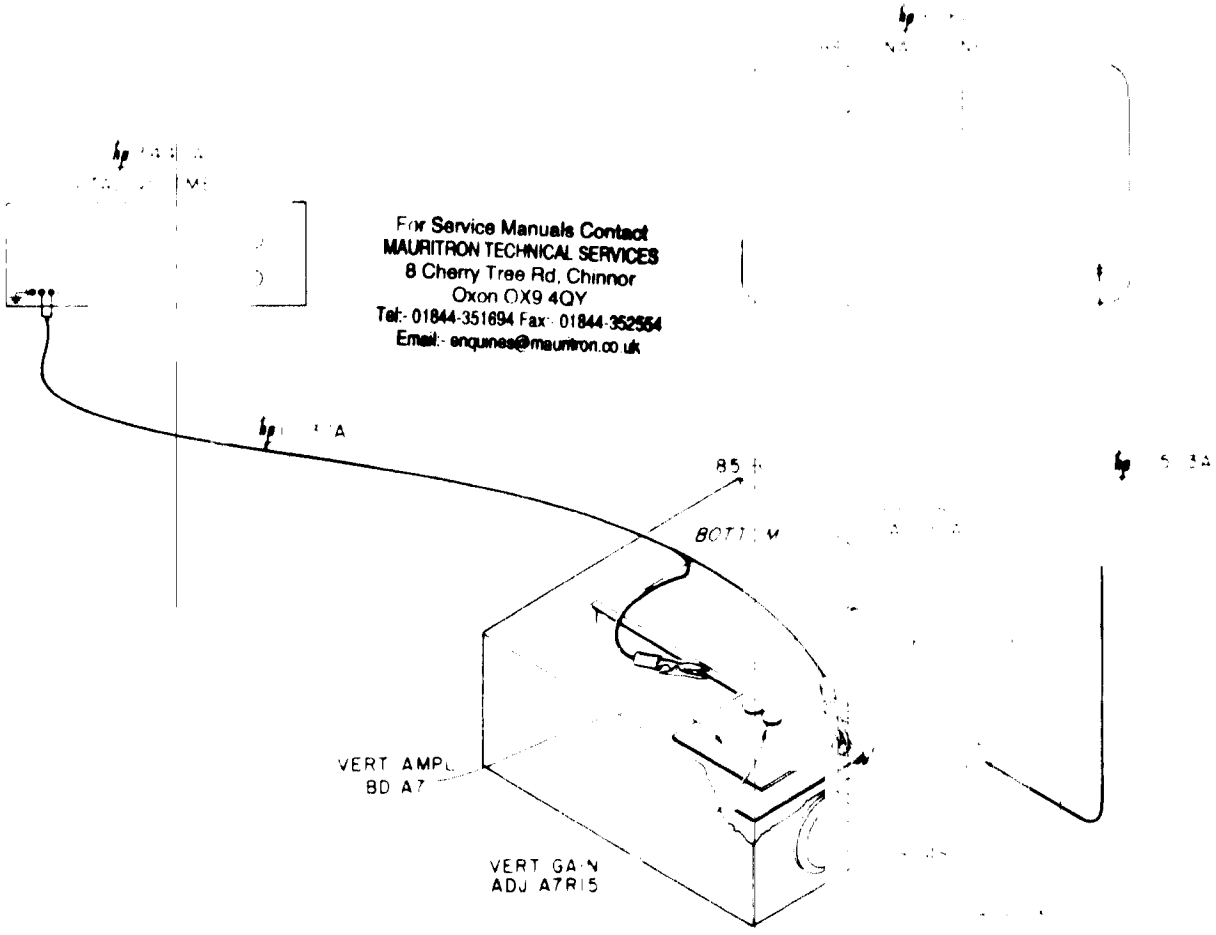


Figure 5-5. Measurement Setup, Calibration of 851 Vertical Amplifier

While increasing Oscillator frequency, adjust output level if necessary to maintain signal amplitude same as noted on Oscilloscope in step (1).

(3) The vertical deflection decrease to 5.0 cm should take place at 200 ±40 Kc.

i. Using a 1 Kc signal while obtaining a 7.0 cm vertical deflection, check other positions of I. F. BANDWIDTH using procedure given in step h. Frequency at which deflection should decrease to 5.0 cm is given in Frequency column of Table 5-18.

Table 5-18. Data for Video Bandwidth Check

I. F. BANDWIDTH Setting	Frequency
100 KC	200 ±40 Kc
10 KC	40 ± 8 Kc
3 KC	12 ±2.4 Kc
1 KC	4 ±0.8 Kc

j. Disconnect Oscillator from Vertical Amplifier Input Cable A2W6, and reconnect Cable to RF Circuit Assembly A2 feed-thru terminal.

5-82. IMC I.F.BANDWIDTH ALIGNMENT AND CHECK.

5-83. EQUIPMENT REQUIRED

Ref No.	Equipment	No.
7*	[illegible]er (5245L)	1
9*	Signal Generator (606A	1
D**	Shielded cable term[illegible] w BNC males (10503A)	1
F**	BNC tee, male and 2 females (UG-274A U)	1
G**	Plastic tuning wand	1
	Adapter, male type N to female BNC (UG-201A U) hp 1250-0067	1

*Table 5-1 **Table 5-2

5-84. SETUP AND INITIAL SETTINGS

a. Setup. See Figure 5-7. Casting which houses RF Circuit Assembly A2 is on bottom of 8[illegible]d that which houses Bandpass Filter Assem[illegible] in top of 851, on right side near front pan[illegible] to both is required in this procedure. Loca[illegible] Assemblies and adjustments are called [illegible]

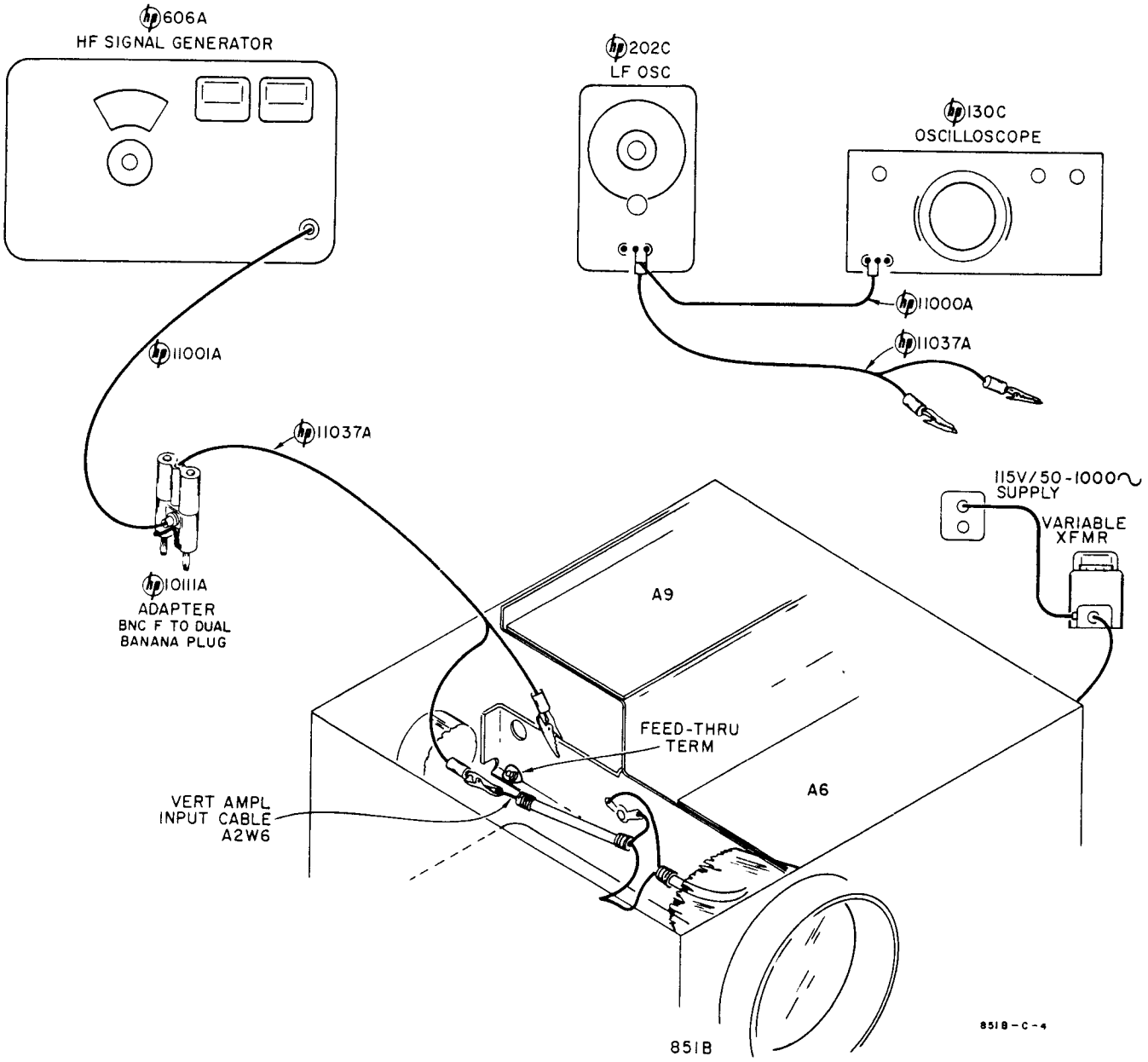


Figure 5-6. Setup for 851 Video Bandwidth Measurements

5-7 and 5-8. With top and bottom covers removed, rest 851 on its right side. Access holes in cover plates of Assembly castings are provided for adjustments called for in alignment procedure; holes are covered by removable plug-in buttons.

b. Settings:

SYNC	INT
SWEEP TIME	3 MILLISEC/CM
I.F. BANDWIDTH	1 MC
VERT DISPLAY	LIN

c. Initial Procedure. Set Signal Generator for 20 Mc at -10 dbm.

5-85. 1 MC ALIGNMENT.

a. With modified GC plastic Tuning Wand, adjust 851 Detector Tune T1 (A2A7T1) for maximum deflection on CRT.

Note

Two peaks are present; adjust for maximum deflection of the highest.

b. Tune L11 Imped Adj (A2A6L11) and A12 adjustments C1, C3, L2 for maximum vertical deflection.

Note

Adjustment of A12C1, A12C3, and A12L2 presets them; final adjustment of A12C1, A12C3, and A12L2 is made with 851 connected to 8551 (see Paragraph 5-93b).

5-86. 1MC BANDWIDTH CHECK.

a. Set Signal Generator output level for 7.0 cm 851 display.

b. While watching 851 display, decrease frequency at Signal Generator until 851 display amplitude is 5.0 cm. Note Counter reading.

c. Still watching 851 display, increase frequency and observe display go through maximum and return to 5.0 cm. Note Counter reading.

Frequency difference between the two readings should be within 1.4 and 2.2 Mc.

5-87. 100KC I.F.BANDWIDTH ALIGNMENT AND CHECK.

5-88. SETUP AND INITIAL SETTINGS.

a. Use setup indicated in Figure 5-7. 100KC Bandpass Filter Assemblies A3 and A5 are located toward rear of 851 on right side, beneath Low-Voltage Power Supply A9; access to adjustments A3L1 and A5L1 is through holes in the A9 Board; see Figure 5-36.

b. Use same initial procedure as given in Paragraph 5-84, subparagraph c, changing control settings as follows:

SPECTRUM WIDTH	100 KC/CM
I. F. BANDWIDTH	100KC

5-89. 100KC ALIGNMENT. Tune L1 Imped Adj (A2A2L1 in RF Circuit Assembly A2) and 100KC Bandpass Filter adjustments A3L1 and A5L1 for maximum vertical deflection.

5-90. 100KC BANDWIDTH CHECK.

a. Set Signal Generator output level for 7.0 cm 851 display.

b. While watching 851 display, decrease frequency at Signal Generator until 851 display amplitude is 5.0 cm. Note Counter reading.

c. Still watching 851 display, increase frequency and observe display go through maximum and return to 5.0 cm. Note Counter reading.

Frequency difference between the two readings should be within 80 and 120 Kc.

5-91. FINAL 1MC AND 100KC BANDWIDTH ADJUSTMENTS.

5-92. SETUP. Connect the 851 to the 8551; see Figures 2-1 and 5-8.

a. Set 8551:

LINE	STANDBY
SIGNAL IDENTIFIER	OFF
SPECTRUM WIDTH VERNIER	CAL
FREQUENCY (GC)	.01-2
I. F.	2GC
FREQUENCY TUNING	COARSE
ATTENUATOR (DB)	60

Set 851:

SYNC	INT
SWEEP TIME	3 MILLISEC/CM
I. F. BANDWIDTH	1MC
VERT DISPLAY	LIN

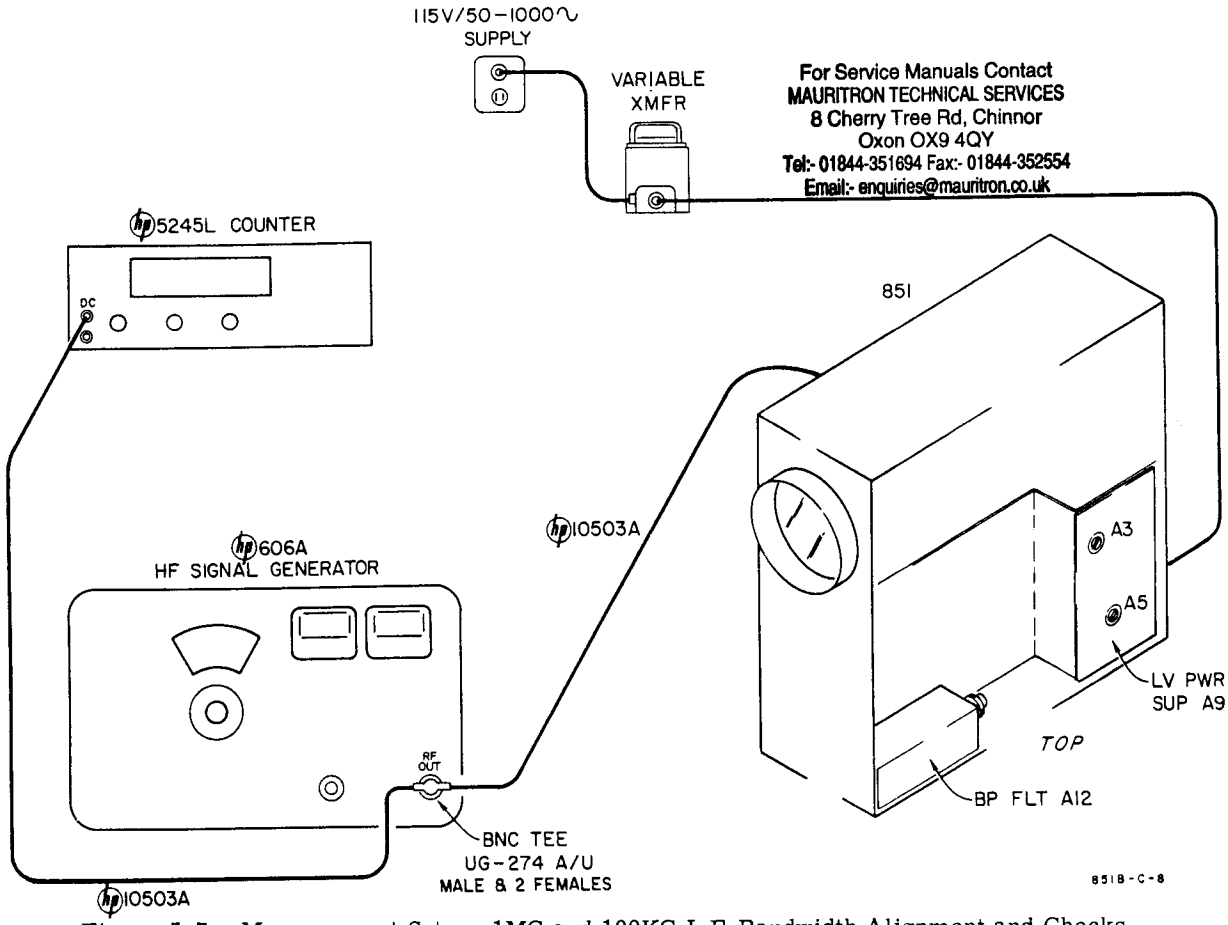


Figure 5-7. Measurement Setup, 1MC and 100KC I. F. Bandwidth Alignment and Checks

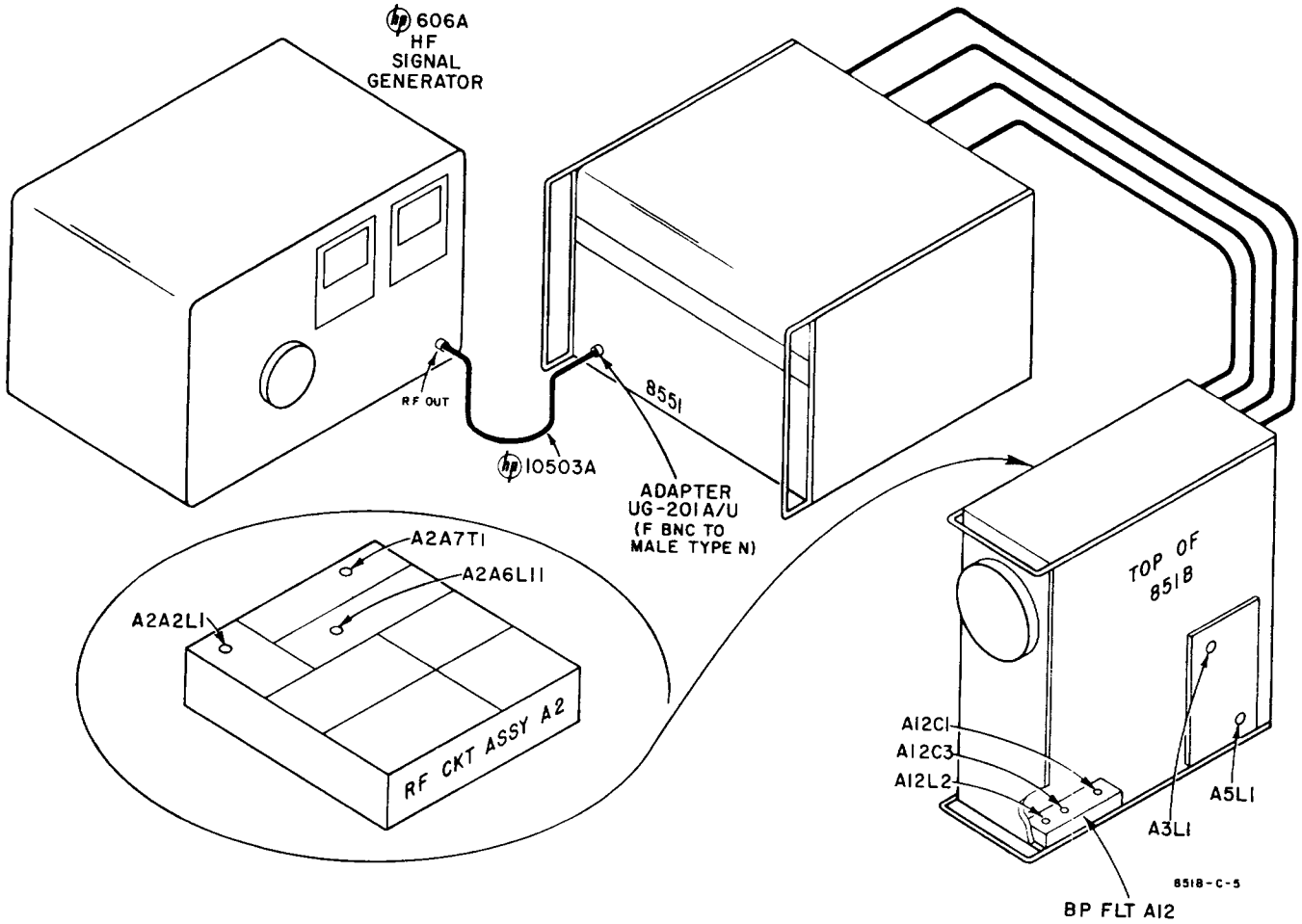


Figure 5-8. Measurement Setup, 10KC I. F. Bandwidth Alignment and Checks

b. Set Signal Generator for some frequency above 10 Mc, such as 50 Mc, and at some level less than 1 watt.

c. Perform steps 1 through 14 of Initial Operating Procedure, Figure 3-3, using settings given in step a.

5-93. PROCEDURE.

a. Set SPECTRUM WIDTH . . . . . 1 MC/CM
VERT DISPLAY . . . . . LOG

b. Check symmetry, and if necessary readjust A12C1, A12C3, and A12L2 for best symmetry.

c. Set SPECTRUM WIDTH to 100KC/CM.

d. Check symmetry, and if necessary readjust A12C1, A12C3, and A12L2 in Bandpass Filter Assembly A12 for best symmetry.

e. Switch VERT DISPLAY back to LIN, and if necessary readjust A2A2L1, A3L1, and A3L5 for best compromise on symmetry and amplitude while keeping bandwidth within 100 ±20 Kc.

f. Recheck at LOG, then LIN, readjusting as required.

g. Return VERT DISPLAY to LIN, set I. F. BANDWIDTH to 1 MC, and SPECTRUM WIDTH to 1 MC/CM.

h. Check display for maximum amplitude, correct bandwidth, and symmetry, readjusting Impedance Adj A2A6L11 if required.

i. Set VERT DISPLAY at LOG and, if required, readjust A12C1, A12C3, and A12L2 for best symmetry and amplitude.

j. Set I. F. BANDWIDTH to 100KC and SPECTRUM WIDTH to 100 KC/CM, and again check the 100 Kc filter bandpass characteristics.

k. Continue readjusting as required to obtain the best compromise on amplitude and symmetry with VERT DISPLAY at LIN and LOG for both 1 Mc and 100 Kc filters while keeping respective bandwidths within specifications.

5-94. 10KC, 3KC, AND 1KC I.F.BANDWIDTH ALIGNMENT AND CHECKS.

5-95. Signals for the three narrower bandwidths (1, 3, and 10 Kc) pass through four tuned filters. The coil (A2A3L1, A2A3L2, A2A4L1, A2A4L2) in each filter is tapped; change in bandwidth is obtained by using different taps for each bandwidth. The same four filters, however, are used for the three bandwidths, and therefore accurate adjustment of the 10-Kc bandwidth should bring the 3-Kc and 1-Kc bandwidths within specifications. After bandwidth is set with I. F. BANDWIDTH at 10KC, bandwidth is checked

at the 3KC and 1KC settings. I. F. bandwidth alignment is not a simple technique. While tuning for correct I. F. bandwidth, remember:

a. Ideally, all adjustments should be made simultaneously. Since this is impossible, it will be necessary to repeat adjustments more than once to obtain best tuning of the four filters.

b. Final adjustment should be the compromise which obtains best characteristics for all four filters.

5-96. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
10*	VHF Attenuator (355D)	1
D**	Shielded coax cable term. w/ BNC males (10503A)	1
G**	GC plastic tuning wand	1
K**	Screwholding screwdriver	1

*Table 5-1 **Table 5-2

5-97. MEASUREMENT SETUP.

5-98. Use the 8551 RF Section as the signal source for the narrower I. F. bandwidth alignment procedures. See Figure 5-8.

a. Connect the 8551 to 851 as shown in Figure 2-1, except for the 200MC cable.

b. Insert a VHF Attenuator, such as the 355D, between 200MC OUTPUT and INPUT on the rear of the 8551. The cable which straps 200MC OUTPUT to INPUT can be used for the connection to one 355D port; use a coaxial cable such as the 10503A to make connection between the other 355D port and 200MC INPUT.

5-99. 10KC PROCEDURE.

5-100. INITIAL.

a. Set the 355D to 30 db.

b. Perform steps 1 through 6 of Turn-On Procedure, Figure 3-3, using the following settings:

8551
LINE . . . . . STANDBY
SIGNAL IDENTIFIER . . . . . .OFF
SPECTRUM WIDTH . . . . . 1 MC/CM
SPECTRUM WIDTH VERNIER . . . . . CAL
FREQUENCY (GC) 01-2
TUNE . 2GC on LOCAL OSC FREQ (F_{LO}) scale
FREQUENCY TUNING . . . . . FINE

851
BASE LINE CLIPPER . . . . . max ccw
SYNC . . . . . INT
I. F. BANDWIDTH 100KC
VERT DISPLAY . . . . . LIN
SWEEP TIME . . . . . 3 MILLISEC/CM
VERNIER . . . . . .CAL
INTENSITY . . . . . about 3 o'clock
I. F. GAIN . . . . . 30 + 0
I. F. VERNIER . . . max ccw (minimum gain)

c. Set LINE to ON. After a warmup of about five minutes, find and center the 2-Gc feed-through signal. Bringing the signal onto the display probably will require some readjustment of TUNE and insertion of more attenuation; use the 355D -- a setting of 70 db is typical.

d. After finding and centering the signal, stabilize the Analyzer (see Figure 3-5, 851A/8551A Manual).

e. Check alignment of the base-line trace with the horizontal axis. If necessary, adjust VERT POS and TRACE ALIGN to bring base-line trace exactly parallel with and on the graticule base line.

5-101. 10KC ALIGNMENT.

a. Set
SPECTRUM WIDTH 10KC/CM
I. F. BANDWIDTH 10KC
SWEEP TIME . . . . . 3 MILLISEC/CM

b. Adjust TUNE to center signal on 851 display. Adjust 851 I. F. GAIN and I. F. VERNIER for a vertical deflection of exactly 7.0 cm.

c. Bandwidth tuning adjustments are inside the RF Circuit Assembly casting, and location of adjustments is marked on the cover. Access holes, covered with removable plug-in buttons, are provided in the casting cover. However, though it can be done, presetting (step d) two of the capacitors is a little difficult with the casting cover on. If you prefer to remove the casting cover, do so at this point in the procedure. Casting cover is held on by 26 screws with integral washers; use of a screwholding screwdriver is helpful. Figure 5-22 shows the boards in RF Circuit Assembly A2.

d. Preset BALANCE ADJ capacitors A2A3C5 and A2A4C8 to approximately 1/3 mesh.

e. Adjust 1-10KC BANDWIDTH ADJ capacitors A2A3C4, A2A3C2, A2A4C5, and A2A4C9 for maximum bandwidth.

Note

In tuning capacitor A2A3C4, A2A3C2, or A2A4C5 through its tuning range it will be found there are two points which give vertical deflection peaks. Since there is little difference between the amplitude of the two peaks, it is difficult to distinguish which is the spurious tuning region. However, correct I. F. bandwidth tuning can be obtained only when adjustment of each capacitor is made in the true tuning region. Also, maximum bandwidth usually is obtained by tuning off the peak slightly.

f. Adjust IMPED ADJ A2A3L3 and FREQUENCY ADJ A2A4C7 for maximum vertical deflection.

g. Center display with TUNE, and set vertical deflection to 7.0 cm with I. F. GAIN. If display is not 1 cm wide at the 5-cm (half-power) points, again perform steps e through g until a 1-cm bandwidth at the 5-cm points is obtained.

5-102. 3KC AND 1KC BANDWIDTH CHECKS.

5-103. CALIBRATION. To read bandwidth at 3KC and 1KC, it is necessary to increase resolution to 1 Kc/cm by calibrating the VERNIER; procedure follows:

a. Set
I. F. GAIN . . . . . 30 + 0
I. F. VERNIER . . . . . max ccw
Check that I. F. BANDWIDTH is 10KC
SPECTRUM WIDTH is . 10 KC/CM
SPECTRUM WIDTH
VERNIER is. . . . . CAL

b. At the 355D, adjust for vertical display of 4 to 5 cm.

c. With 0-to-10 I. F. GAIN control, adjust for vertical display of between 6 and 7 cm.

d. Use I. F. VERNIER to bring signal amplitude to exactly 7.0 cm.

e. Center signal with TUNE.

f. With SPECTRUM WIDTH VERNIER, expand signal until it is 10 cm at the 5.0-cm axis. Since signal width at the 5.0-cm axis was initially adjusted to 1 cm, SPECTRUM WIDTH was set for 10 KC/CM, and the 10-Kc display has been expanded to 10 cm, display scale at this setting of SPECTRUM WIDTH VERNIER is 1 Kc/cm.

5-104. BANDWIDTH CHECKS.

a. Set I. F. BANDWIDTH to 3KC.

b. Adjust I. F. GAIN and I. F. VERNIER for vertical deflection of exactly 7.0 cm.

c. Width of display at 5.0-cm axis should be between 2.4 and 3.6 cm.

d. Set I. F. BANDWIDTH to 1KC.

e. Adjust I. F. GAIN and I. F. VERNIER for vertical deflection of exactly 7.0 cm.

f. Width of display at 5.0-cm axis should be between 0.8 and 1.2 cm.

Note

If 1-Kc bandwidth appears to be too wide, recheck tuning of FREQ ADJ A2A4C7 (see Paragraph 5-101f).

5-105. FINAL 1-10KC BANDWIDTH ADJUSTMENT.

5-106. Set I. F. BANDWIDTH at 10KC, and recheck bandwidth making adjustments if necessary.
When maximum vertical deflection is 7.0 cm, at 5.0 cm bandwidth should be within 0.8 and 1.2 cm.

5-107. AUTO SELECT CHECK.

5-108. With I. F. BANDWIDTH at AUTO SELECT, the Analyzer automatically selects the I. F. bandwidth which provides optimum operation for whatever combination of 8551 SPECTRUM WIDTH and 851 SWEEP TIME settings is selected.

5-109. Connections to the filters which determine I. F. bandwidth are made through relays. With I. F. BANDWIDTH at 1KC, 3KC, 100KC, or 1 MC, dc to operate the relays is applied via contacts on the I. F. BANDWIDTH switch. With I. F. BANDWIDTH at AUTO SELECT, however, dc to operate the relays is applied via contacts on the 8551 SPECTRUM WIDTH switch and the 851 SWEEP TIME switch. Inter-unit connections required for automatic selection of I. F. bandwidth are carried in the CONTROL cable.

5-110. To check that the AUTO SELECT feature is functioning, I. F. BANDWIDTH, SPECTRUM WIDTH, and SWEEP TIME are given the settings known to result in optimum operation, the display is noted, then I. F. BANDWIDTH is set to AUTO SELECT, and the resulting display is compared to the preceding display. To perform this check:

a. Connect (see Figure 2-1) the 851 to an 8551 known to be in adjustment.

b. Perform the initial operating procedure, Figure 3-3, using an input signal of less than a watt, 10 Mc or higher in frequency.

c. Set
SPECTRUM WIDTH . . . . . 10 KC/CM
SWEEP TIME . . . . . 10 MILLISEC/CM
I. F. BANDWIDTH . . . . . 1 KC

d. Note display.

e. Switch I. F. BANDWIDTH to AUTO SELECT.

f. Note display; it should be same as display noted in step d.

g. Follow same procedure for all settings shown in Table 5-19, switching to AUTO SELECT after each change of switch settings.

Table 5-19. Switch Settings for AUTO SELECT Check

I. F. BANDWIDTH	SPECTRUM WIDTH	SWEEP TIME
1 KC	10 KC/CM	10 MILLISEC/CM
	30 KC/CM	30 MILLISEC/CM
	100 KC/CM	.1 SEC/CM
	300 KC/CM	.3 SEC/CM
	1 MC/CM	1 SEC/CM
3 KC	10 MC/CM	1 SEC/CM
	3 MC/CM	.3 SEC/CM
	1 MC/CM	.1 SEC/CM
	300 KC/CM	30 MILLISEC/CM
	100 KC/CM	10 MILLISEC/CM
	30 KC/CM	3 MILLISEC/CM
10 KC	300 KC/CM	3 MILLISEC/CM
	1 MC/CM	10 MILLISEC/CM
	3 MC/CM	30 MILLISEC/CM
	10 MC/CM	.1 SEC/CM
	30 MC/CM	.3 SEC/CM
	100 MC/CM	1 SEC/CM
100 KC	200 MC/CM	.3 SEC/CM
	100 MC/CM	.1 SEC/CM
	30 MC/CM	30 MILLISEC/CM
	10 MC/CM	10 MILLISEC/CM
	3 MC/CM	3 MILLISEC/CM

5-111. I.F.SENSITIVITY CHECK.

5-112. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
3*	Variable Transformer, set for 115V	1
9*	Signal Generator (606A)	1
D**	Shielded cable, BNC male to male (10503A)	1
*Table 5-1 **Table 5-2		

5-113. MEASUREMENT SETUP. Connect Signal Generator to I. F. INPUT (on 851 rear) and line voltage through a variable transformer set for 115V.
Set 851:
I. F. GAIN (DB) 80
I. F. VERNIER . . . . . full ccw

5-114. SIGNAL LEVEL CHECK.

a. Set Signal Generator for 20 Mc output.

b. Set I. F. BANDWIDTH to 1 Mc, and adjust Signal Generator output level to obtain 6 cm of vertical deflection on 851 CRT. The 6-cm deflection should be obtained with Signal Generator output level at -57.5 dbm ±4.5 dbm.

c. Adjust Signal Generator output level to obtain 6 cm of vertical deflection on 851 CRT at each setting of I. F. BANDWIDTH. Level at which 6 cm deflection should be obtained at each I. F. BANDWIDTH setting is given in Table 5-20.

d. Disconnect Signal Generator.

Table 5-20. Data for I. F. Sensitivity Check

I. F. BANDWIDTH Setting	Input-signal Level Limits*
1MC	-62 to -53 dbm
100KC	-75 to -60 dbm
10KC	-95 to -80 dbm
3KC	-95 to -80 dbm
1KC	-86 to -71 dbm
* For 6 cm deflection with I. F. GAIN at 80 db and VERNIER full counterclockwise	

5-115. NOISE LEVEL CHECK. With no signal connected to I. F. INPUT, switch I. F. BANDWIDTH through all positions. The noise displayed on the CRT should not exceed 0.45 cm at any setting of I. F. BANDWIDTH.

5-116. VERT DISPLAY CHECKS AND ADJUSTMENTS.

5-117. PRELIMINARY CHECK.

a. Connect to line voltage through Variable Transformer, set for 115V.
b. Set 851 VERT DISPLAY . . . . . LOG
I. F. GAIN (DB) 20
I. F. VERNIER . . . . . full cw
I. F. BANDWIDTH . . . . . 1 MC

c. With no signal input, check that trace aligns with graticule base line.

5-118. LOG DISPLAY.

5-119. ADJUSTMENT.

a. Connect Signal Generator to I. F. INPUT; set for 20 Mc output at level which obtains 1 cm of vertical deflection on 851 CRT.

b. On 851, increase I. F. GAIN to 40 db, and adjust A11R13 (on VERT DISPLAY switch, see Figure 5-25) for 3 cm of vertical deflection.

c. Increase I. F. GAIN to 60 db, and adjust A11R14 (Figure 5-25) for 5 cm of vertical deflection.

d. Increase I. F. GAIN to 80 db (outer control at 70, inner at 10), and adjust potentiometer A11R20 (Figure 5-25) for 7 cm of vertical deflection.

e. Decrease I. F. GAIN 1 db, and note deflection level. Reset I. F. GAIN to 80 db (70 + 10), and rotate I. F. GAIN VERNIER fully counterclockwise.
Deflection level decrease should exceed 1 db.

f. Reset I. F. GAIN VERNIER fully clockwise.

5-120. LINEARITY CHECK.

a. Decrease I. F. GAIN in steps of 10 db, and observe trace.
Each step should lower trace 1.0 cm on CRT and, at each 10-db step, alignment between trace and horizontal line on graticule should be within ±0.2 cm.

b. Reset I. F. GAIN to 70 - 10, and repeat step a for all other I. F. bandwidths.

5-121. SQ DISPLAY.

5-122. ADJUSTMENT.

a. On 851 set:
VERT DISPLAY . . . . . SQ
I. F. GAIN (DB) . . . . . 20 + 10
(outer control at 20, inner control at 10)

b. Set Signal Generator signal level to give 7.0 cm of vertical deflection on 851 CRT.

c. Decrease I. F. GAIN 6 db, and adjust .710 SQ CALIB A11R2 (Figure 5-25) for 1.75 cm of vertical deflection.

d. Increase signal level for 7.0 cm vertical deflection; decrease I. F. GAIN 6 db in 3-db steps. See Table 5-21 for vertical deflection limits.

Table 5-21. SQ Display Linearity Check Data

I. F. GAIN (DB) Settings	Step	Vertical Deflection (cm)
30	Ref	7.0
27	-3 db	3.15 - 3.85
24	-6 db	1.40 - 2.10

e. Perform step d at all other I. F. bandwidths.

5-123. LIN DISPLAY LINEARITY CHECK.

a. Set 851
VERT DISPLAY . . . . . LIN
I. F. GAIN (DB) . . . . . 30 (20 + 10)

b. Increase signal level for 7.0 cm of vertical deflection.

c. Decrease I. F. GAIN 12 db in 6-db steps; what the vertical deflection should be at each step is shown in Table 5-22.

Table 5-22. LIN Display Linearity Check Data

I. F. GAIN (DB) Settings	Step	Vertical Deflection (cm)
30	Ref	7.0
24	-6 db	3.29 - 3.71
18	-12 db	1.54 - 1.96

d. Repeat steps b and c at all other I. F. bandwidths.

5-124. FINAL I.F. BANDWIDTH ADJUSTMENTS.

5-125. EQUIPMENT REQUIRED.

Ref No.	Equipment	No.
11*	UHF Signal Generator (8614A)	1
	8551 (adjusted)	1
H**	3-ft shielded coax cable term. w/ type N males (11500A)	1
G**	GC plastic tuning wand	1

*Table 5-1 **Table 5-2

5-126. MEASUREMENT SETUP AND INITIAL PROCEDURE.

a. Setup. Remove top and bottom covers from 851 and top cover from 8551; connect as indicated in Figure 5-9.

b. Settings:

(1) 8551:
LINE . . . . . .STANDBY
SPECTRUM WIDTH VERNIER . . . . CAL
SPECTRUM WIDTH . . . . . 300 KC/CM
FREQUENCY TUNING . . COARSE or FINE
FREQUENCY (GC) 01-2
I. F. . . . . 2 GC
TUNE . . . . . 1.8 GC
FREQUENCY IDENTIFIER . . . . . OFF

(2) 851:
SWEEP TIME . . . . . 30 MILLISEC/CM
SWEEP TIME VERNIER . . . . . CAL
I. F. BANDWIDTH . . . . . 10 KC
VERT DISPLAY . . . . . LOG
I. F. GAIN (DB) 80
I. F. GAIN VERNIER . . . . . full cw

(3) Signal Generator:
Frequency . . . . . 1.8 Gc
Output level . . . . . 0 dbm

c. Initial Procedure:

(1) Follow steps 1-14 of initial operating procedure, Figure 3-3, using above settings.

(2) Switch FREQUENCY TUNING to STABILIZE, and stabilize Analyzer (see Figure 3-5, 8551A Manual).

5-127. CRYSTAL FILTER (10KC, 3KC, 1KC) BALANCE.

a. Adjust Signal Generator output level at 60 Mc for 7 cm of vertical deflection on 851 CRT.

b. Tune BALANCE ADJ A2A3C5 and A2A4C8 for a symmetrical display. Capacitor locations are marked on RF Circuit Assembly A2 cover plate, and capacitors can be tuned through access holes in cover plate.

c. Set I. F. BANDWIDTH and SPECTRUM WIDTH as shown in the following table, and readjust A2A3C5

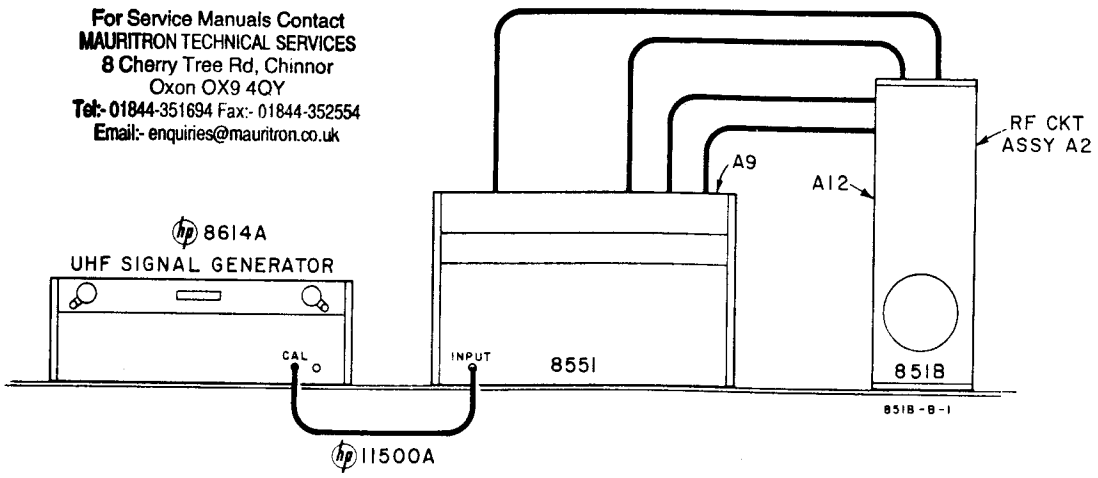


Figure 5-9. Measurement Setup, Final I. F. Bandwidth Adjustments

and A2A4C8 for best symmetry compromise for the three bandwidths.

851 I. F. BANDWIDTH	8551 SPECTRUM WIDTH
3KC 1KC	100 KC/CM 30 KC/CM

5-128. 1MC BANDPASS FILTER ADJUSTMENTS.

5-129. ADJUSTMENT LOCATIONS. Location of Bandpass Filter Assembly A12 in top of 851 is shown in Figure 5-8, and that of Converter Assembly A9 in top of 8551 is indicated in Figure 5-9. Both assemblies are housed in castings, and each provides access to adjustments through holes in top cover plate.

5-130. PROCEDURE.

a. Set:
SPECTRUM WIDTH . . . . . 1 MC/CM
VERT DISPLAY . . . . . LIN

b. Set I. F. BANDWIDTH to 100 KC/CM, and center display with TUNE.

c. Adjust A12C1 and A12C2 in the 851 and A9A2L2 in the 8551 for best symmetry and a 1-Mc bandwidth.

Note

A12C1 and A12C2 control bandwidth, and A9A2L2 mainly the frequency at which maximum amplitude occurs.

d. Switch I. F. BANDWIDTH to 100 KC/CM, and check that frequency at which maximum amplitude occurs does not shift. Readjust A9A2L2, as required, to assure maximum amplitude occurs at same frequency with I. F. BANDWIDTH in 100KC and 1MC positions.

5-131. TROUBLESHOOTING.

5-132. LOCALIZATION.

5-133. First use the in-the-cabinet performance checks, Tables 5-6 and 5-7, to localize trouble.

a. If these checks localize trouble to a particular part of the instrument, first make a visual check for broken leads, overheated resistors, or cold solder joints before making an electrical check. If this inspection yields no information, first check the LV Power Supply (see Paragraph 5-40), and then the part of the circuit that appears to be in trouble (see the appropriate part of Table 5-13).

b. If the performance checks fail to localize the trouble, check the instrument using procedures given in Table 5-13.

5-134. PARTS LOCATION.

5-135. The key to parts locations is in the part designation.

a. If a component is mounted on an Assembly board, the designation is prefixed with the Assembly number, e.g., A1R5. Location of each Assembly is called out in Figures 5-10 and 5-11. In addition, a picture of each Assembly board is provided, and all components on the Board are identified. For the most part, Board pictures face the schematic in which the Assembly appears. All Board pictures are listed in the List of Illustrations.

b. If a component is mounted on the chassis, the designation has no prefix, e.g., R5. Since these parts are harder to locate, a Locater list, Table 5-5, has been prepared which gives information on how to locate the part.

5-136. ISOLATING TROUBLE IN TRANSISTOR CIRCUITS.

5-137. For general data on transistors, see Paragraph 5-163 and Figure 5-16.

5-138. IN-CIRCUIT TESTING.

a. When checking a transistor stage, first determine if the emitter-base junction is forward-biased. Do not place an electronic voltmeter directly across the junction to measure the voltage difference; there could be sufficient loop current between the voltmeter leads to damage the transistor. Instead, measure each voltage separately with respect to a common point (e.g., chassis). If junction is not forward-biased, and power supply voltages are known to be correct, the base-emitter junction may be open (see Paragraph 5-139).

b. If the emitter-base junction is forward-biased, check for amplifier action by short-circuiting base to emitter while observing collector voltage. The short eliminates base-emitter bias and should cause the transistor to stop conducting. Collector voltage should then shift to near the supply voltage. Any difference is due to leakage current through the transistor and, in general, the smaller this current, the better the transistor. If collector voltage does not change, the transistor either has an emitter-collector short circuit or emitter-base open circuit.

5-139. OUT-OF-CIRCUIT TESTING WITH OHMMETER. If a short or open circuit is suspected, remove the transistor from the circuit (see Paragraph 5-145) and use an ohmmeter to measure internal resistance. See Table 5-23 for typical measurement data.

CAUTION

Most ohmmeters can supply enough current or voltage to damage a transistor. Before using the ohmmeter, check ohmmeter open-circuit voltage and short-circuit current output ON THE RANGE TO BE USED. Open-circuit voltage must not exceed 1.5 volts and short-circuit current must be less than 3 ma. See Table 5-23A for safe resistance ranges for some common ohmmeters.

5-140. IN-CIRCUIT TESTING OF TRANSISTORS Q3, Q4, Q5, Q6.

5-141. To check base-emitter junction of transistors Q3, Q4, Q5, or Q6, connect Voltmeter as noted in Table 5-23B. Any sensitive high-impedance voltmeter,

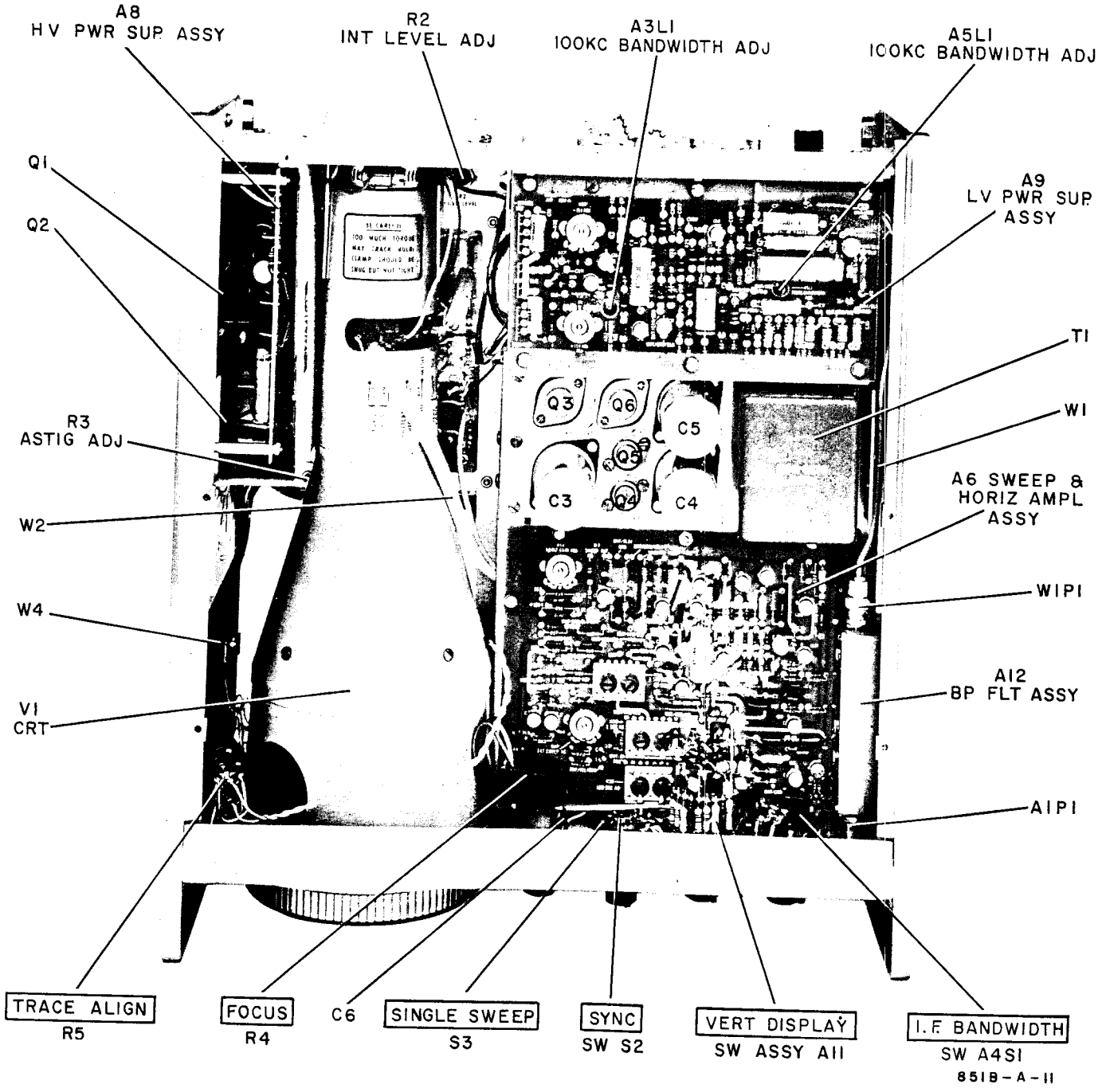


Figure 5-10. 851B Spectrum Analyzer Display Section,
Top View, Top Cover Removed

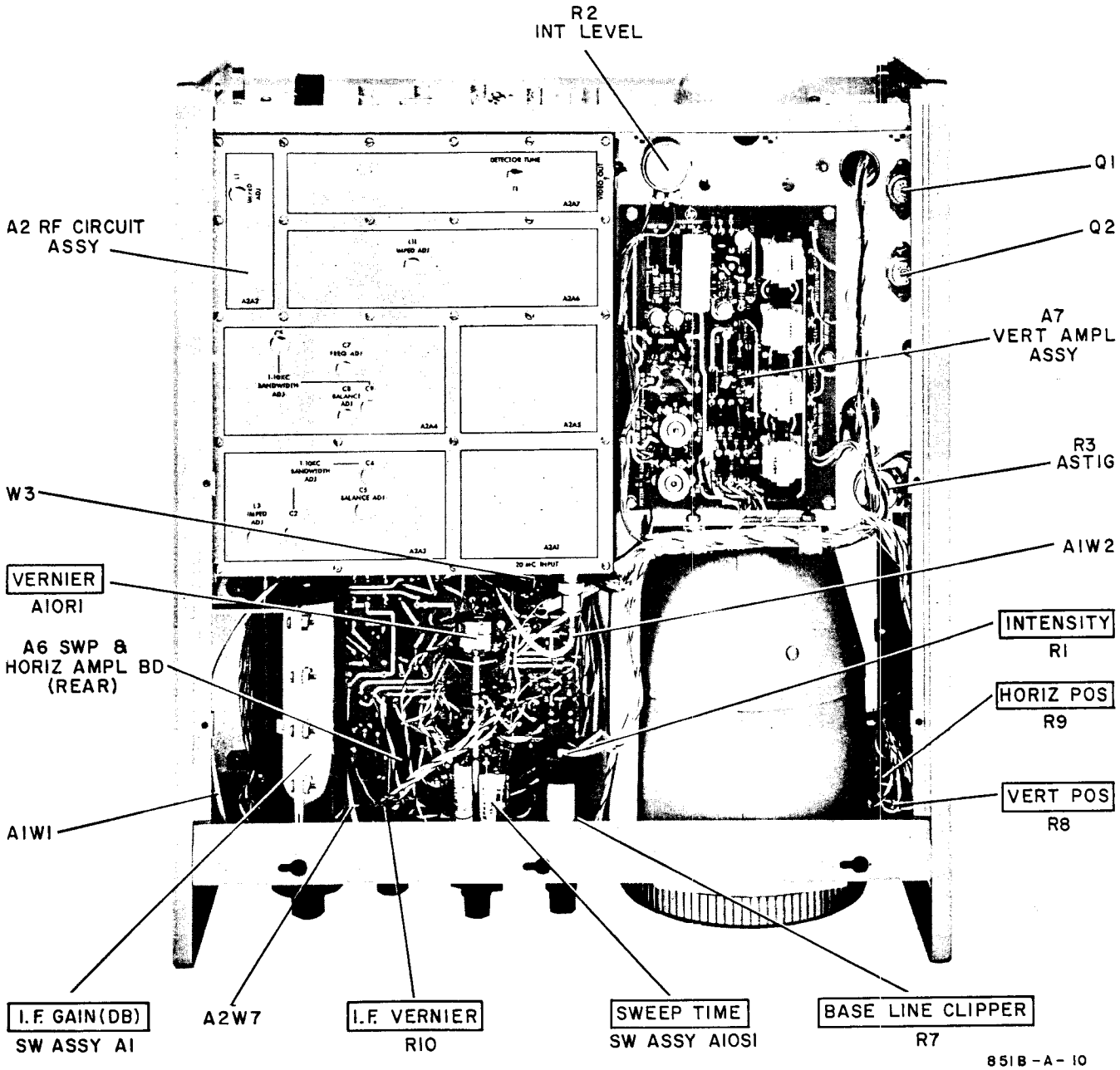


Figure 5-11. 851B Spectrum Analyzer Display Section, Bottom View, Bottom Cover Removed

Table 5-23. Typical Data for Out-of-Circuit Transistor Resistance Measurement

Transistor Type		Connect Ohmmeter Pos lead to	Connect Ohmmeter Neg lead to	Measure Resistance (ohms)
PNP Germanium	Small Signal	emitter	base*	200-500
		emitter	collector	10K-100K
	Power	emitter	base*	30-50
		emitter	collector	several hundred
NPN Silicon	Small Signal	base	emitter	1K-3K
		collector	emitter	very high (might read open)
	Power	base	emitter	200-1000
		collector	emitter	high, often greater than 1M

*To check collector, short collector to base; resistance should decrease.

Table 5-23A. Safe Ohmmeter Ranges for Transistor Resistance Measurements

Ohmmeter	Safe Range(s)	Open Ckt Voltage	Short Ckt Current	Color	Polarity
hp 412A	R x 1K R x 10K R x 100K R x 1M R x 10M	1.0V 1.0V 1.0V 1.0V 1.0V	1 ma 100 μa 10 μa 1 μa 0.1 μa	Red Black	+ -
hp 410C	R x 1K R x 10K R x 100K R x 1M R x 10M	1.3V 1.3V 1.3V 1.3V 1.3V	0.57 ma 57 μa 5.7 μa 0.5 μa 0.05 μa	Red Black	+ -
hp 410B	R x 100 R x 1K R x 10K R x 100K R x 1M	1.1V 1.1V 1.1V 1.1V 1.1V	1.1 ma 110 μa 11 μa 1.1 μa 0.11 μa	Black Red	+ -
Simpson 260	R x 100	1.5V	1 ma	Red Black	+ -
Simpson 269	R x 1K	1.5V	0.82 ma	Black Red	+ -
Triplett 630	R x 100 R x 1K	1.5V 1.5V	32 ma 3.25 ma	Varies with Serial Number	
Triplett 310	R x 10 R x 100	1.5V 1.5V	750 μa 75 μa		

Table 5-23B. Connection Point, Q3, Q4, Q5, Q6 Base-Emitter Forward Bias Check

Xstr	Measurement	Connect VM Between Chassis and Component	Point on Fig. 5-36
Q3	Base to chassis	A9R1	13
Q4	Base to chassis	A9R3	5
	Emitter to chassis	A9R4	4
Q5	Base to chassis	A9C7	3
	Emitter to chassis	A9R16	20
Q6	Base to chassis	A9R16	20
	Emitter to chassis	A9R21	11

such as the hp 3440A Digital Voltmeter or hp 412A Precision V-O-A is suitable.

5-142. REPLACEMENT OF CATHODE-RAY TUBE.

5-143. REMOVAL. It is recommended that a face mask or goggles and gloves be used when it is necessary to handle the CRT. Perform removal procedures with 851 in normal position. To reach the CRT, remove 851 top cover. Parts mentioned in the following procedure are identified in Figure 5-12 by numbered callouts. To remove:

a. Disconnect post-accelerator lead (1).

(1) The post-accelerator lead connects to the tube by means of a spring-clip arrangement (2), and the connection is protected by a rubber cap (3).

(2) Lift edge of cap with screwdriver and, using a pair of long-nose pliers, compress spring contacts as indicated in Figure 5-12. This will free lead-and-spring assembly from recess.

b. Disconnect the six leads (4) at the neck of the CRT. The lead pins pull straight out; be careful not to bend the pins.

c. Remove the four screws which hold bezel to front panel; a No. 2 phillips driver is required.

d. Loosen clamp (5) at socket of CRT.

e. The socket (6) is a tight fit; with a screwdriver carefully pry socket loose, and remove it.

f. While keeping one hand on front face of CRT, carefully slide CRT forward and out of instrument.

5-144. INSTALLATION. Reverse removal procedure. Color-coding of leads to CRT is stamped on CRT shield. After installing new tube, perform CRT checks specified in Table 5-23D.

5-145. TRANSISTOR REPLACEMENT.

5-146. REMOVAL. For the most part, transistors are to be removed from the front of the circuit board. This can be done safely by a skilled technician; a pointed soldering iron is recommended. Refer to

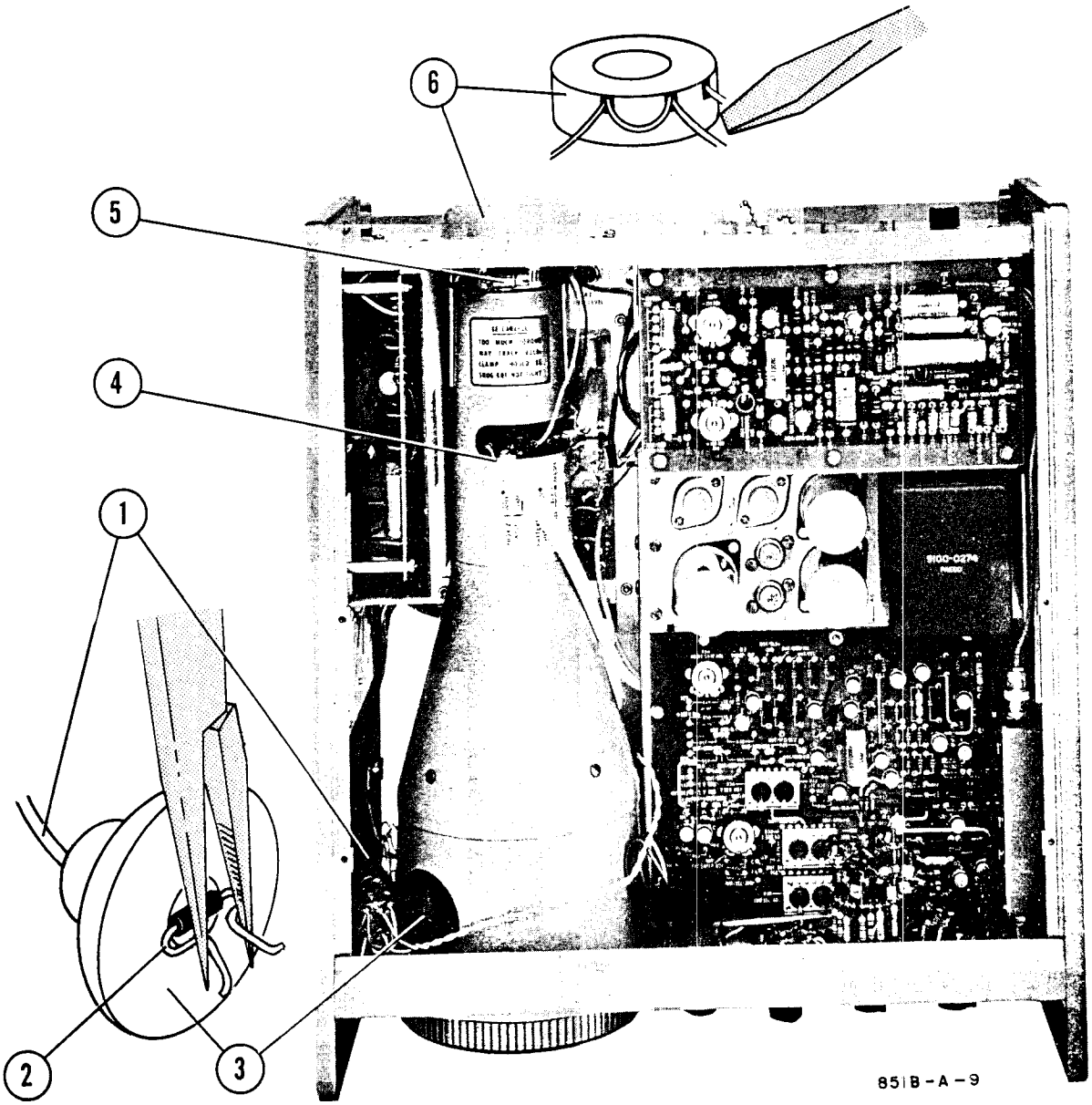


Figure 5-12. Cathode-Ray Tube, Parts and Connections Involved in Removal

Table 5-23C for recommendations regarding component removal, to Paragraph 5-158 for general information about working on etched circuits, to Table 5-23D for recommendations regarding checks to be made after replacing transistors, and to Table 5-23E for recommended soldering equipment.

Note

Do not change an operating voltage or calibration adjustment unless it is either definitely outside specified tolerance, or calibration of a dependent function is unsatisfactory. Improving a marginal adjustment can adversely affect calibration.

5-147. CHASSIS-MOUNTED TRANSISTORS. Transistors Q1 and Q2, which drive the Step-up Transformer in HV Power Supply A8, and Q3, Q4, Q5, Q6, Series Regulators for LV Power Supply A9, are high-current types which require good thermal contact with mounting surfaces for adequate heat dissipation. To assure good thermal contact for a replacement transistor, coat both sides of the black insulator with Dow Corning #5 silicone compound or equivalent before fastening the transistor to the chassis. Dow-Corning #5 compound is available in 8-oz tubes from Hewlett-Packard; order hp stock No. 8500-0059.

5-148. TRANSISTORS Q1, Q2. Location of Q1 and Q2 on the left side of the chassis is called out on Figures 5-10 and 5-11. To test these transistors it is necessary to remove the left (and top) cover plates. To replace Q1 or Q2, it is necessary to remove both the bottom and left-side cover plates. Base, emitter, and collector terminals are identified on the inner side of the deck that Q1 and Q2 are mounted on.

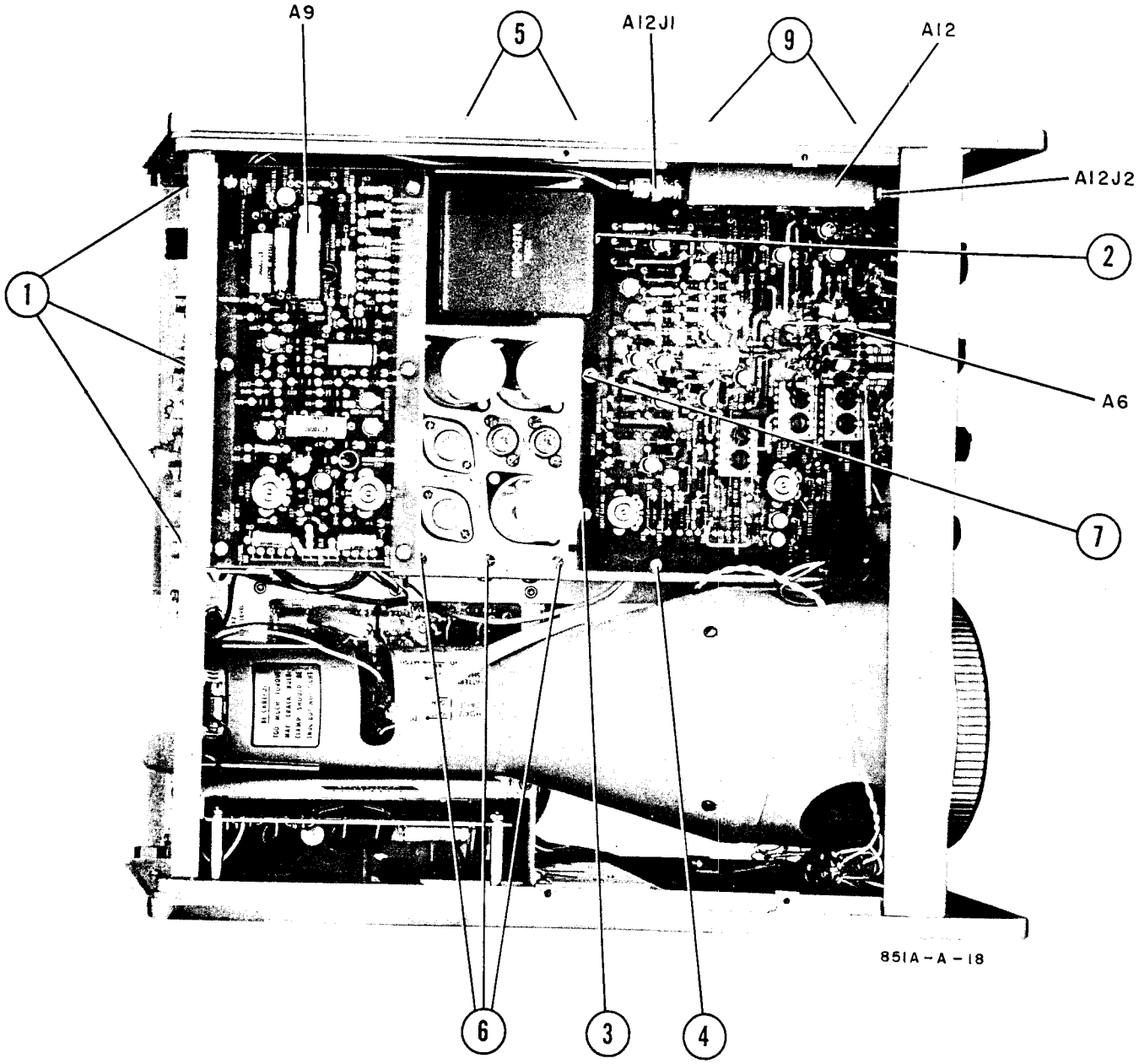


Figure 5-13. Top View of 851 Display Section

5-149. TRANSISTORS Q3, Q4, Q5, Q6. To replace Q3, Q4, Q5, or Q6, it is necessary to gain access to the under side of the deck (see Figure 5-10) on which they are mounted. Procedure follows:

a. Rest 851 on left side. Remove top, bottom, and right-side covers.

b. Refer to Figure 5-13. Remove the three screws designated (1) ; these are 6-32 x 3/8 BH machine screws with integral lockwasher, and are accessible from the rear plate.

c. Remove screws (2) , (3) , (4) ; these are 6-32 x 3/8 BH machine screws, each fitted with a split lockwasher.

d. Remove the two screws designated (5) ; these are 8-32 x 3/8 FH machine screws fitted with integral lockwashers. Screw heads are accessible from right side of instrument.

e. Remove three screws (6) on the deck; these are 6-32 x 3/8 BH machine screws fitted with toothed lockwashers.

f. Remove the 6-32 x 5/16 stainless steel hex nut designated (7) ; a 5/16 socket wrench (Spintite) is recommended. This nut secures a 6-32 x 1/2 spade lug connected to a cable clamp. After removing nut, push down on screw so it will drop out of deck hole and hole in A6 Board.

g. On rear of A6 Board, find screw designated (8) on Figure 5-14. This screw is also a 6-32 x 1/2 spade lug connected to a cable clamp, and is secured to the A6 Board by a nut which is located under Assembly A12.

Longnose pliers can be put on the nut while loosening the screw by going in through an opening on the left side of the instrument.

h. The deck on which the transistors are mounted is now free of its fastenings and can be shifted so the under side can be exposed. One method is to pull it gently out from under the A6 Board, and then turn the deck over. Transistors and their terminals are identified in Figure 5-15.

5-150. REMOVING I.F.GAIN SWITCH ASSEMBLY A1.

5-151. To check or replace components on the I. F. GAIN switch Assembly, it is necessary to remove the switch and its shield. Proceed as follows:

a. Rest 851 on right side, and remove bottom and left-side covers.

b. Remove knobs; each secures to the shaft with an 8-32 x 3/16 setscrew that can be loosened with a No. 8 allen wrench. Loosen locknut under knob with a 1/2" wrench; locknut is a 3/8-32 x 1/2 hex nut.

c. Disconnect cable from A2J1 (on RF Circuit Assembly casting, see Figure 5-14).

d. Disconnect cable from A12J2 (see Figure 5-13). This is a right-angle connector and is a tight fit; if there is difficulty disconnecting it, disconnect the cable from A12J1, remove screws designated (9) which secure A12 to the side casting, and lift Assembly A12 up far enough to disconnect the cable from A12J2.

e. Remove screw (10) (Figure 5-14) which holds Assembly A1 bracket to left-side casting; this is an 8-32 x 1/2 FH machine screw with integral lockwasher.

f. Assembly A1 is now free of its fastenings, but clearance is small. Carefully slide A1 shaft out of front panel being ready to slant A1 to the left as soon as panel-clearance permits. Maneuver A1 free of the instrument.

g. To unfasten the shield, remove five screws (11); these are 6-32 x 1/2 BH machine screws with integral lockwasher.

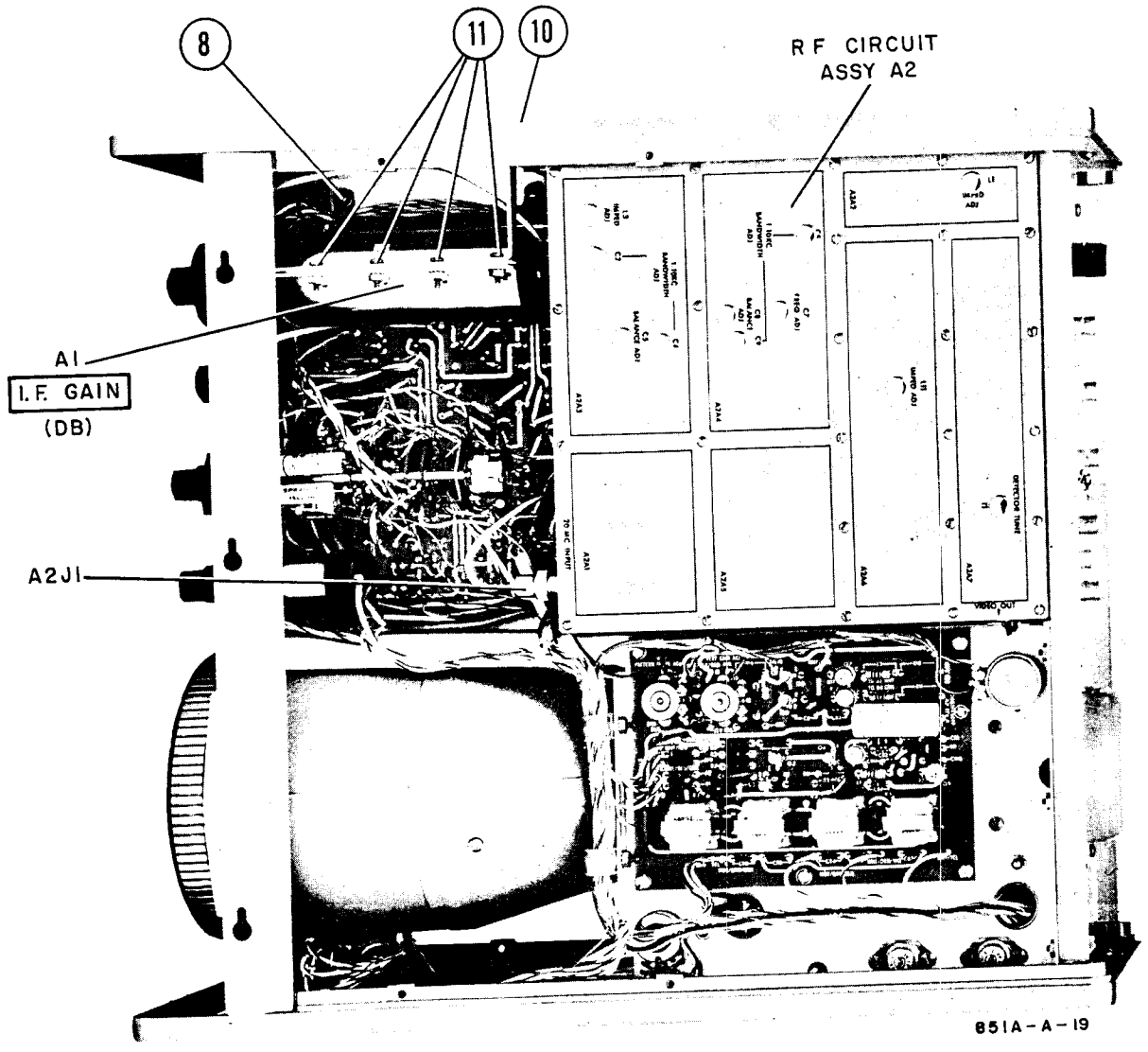


Figure 5-14. Bottom View of 851 Display Section

Table 5-23C. Recommendations, Component Removal

Component p/o (Assy No.)	Access for Unsoldering	Additional Information
A1	Inside metal shield	Par. 5-150, Fig. 5-18
A2	Front of Boards, inside the casting	Remove 851 bottom plate, A2 casting cover; Figs. 5-11, -21, -23, -26
A3		Par. 5-156, Fig. 5-26C
A5		Par. 5-156, Fig. 5-26C
A6	From front or rear of Board; remove 851 top and bottom covers	Figs. 5-10, -11, -31
A7	From front of Board; remove 851 bottom cover	Figs. 5-11, -28
A8	From front of Board; remove 851 top and left-side covers	Figs. 5-10, -34
A9	From front of Board; remove 851 top cover	Figs. 5-10, -36
A10	From switch Assembly; remove 851 bottom cover	Figs. 5-11, -30; Par. 5-154
A11	From switch Assembly; remove 851 top cover	Figs. 5-10, -25; Par. 5-154
A12	Inside metal shield	Par. 5-152, Fig. 5-19
Q1, 2		Par. 5-147, -148; Fig. 5-10
Q3, 4, 5, 6		Par. 5-147, -149; Fig. 5-10

Table 5-23D. Adjustments Required After Component Replacement

Component	Type/Part No.	Function	Adjustment, Par. No.
A2A3Y1	1410-0091	Xtal in 1-10KC BP Filter	1-10KC I. F. Bandwidth Align., Pars 5-82 thru 5-92, 5-128
A2A6CR1-A2A6CR6	1901-0162	Shunt diodes in Current-Controlled Atten	VERT DISPLAY Checks and Adjusts, Pars 5-116 thru 5-123
A3, A5	00851-6028	100KC BP Filter	100KC I. F. Bandwidth Align., Pars 5-87 thru 5-92, 5-128
A7Q8 A7Q9	2N708	p/o Vertical Ampl	Vertical Calibration, Pars 5-77 thru 5-80
A11CR1 A11CR2	1901-0047	p/o SQuare shaping network	VERT DISPLAY Checks and Adjusts., Pars 5-117, 5-122
A11CR3 A11CR4	1901-0047	p/o LOG shaping network	VERT DISPLAY Checks and Adjusts., Pars 5-117, 5-119
V1	5083-0654	CRT	CRT current, voltage checks, Pars 5-45 thru 5-48 Horizontal Calib, Linearity Checks, Pars 5-50 thru 5-54e (3) CRT Checks, Pars 5-69 thru 5-74 Vertical Amplifier Checks and Adjusts., Pars 5-75 thru 5-80

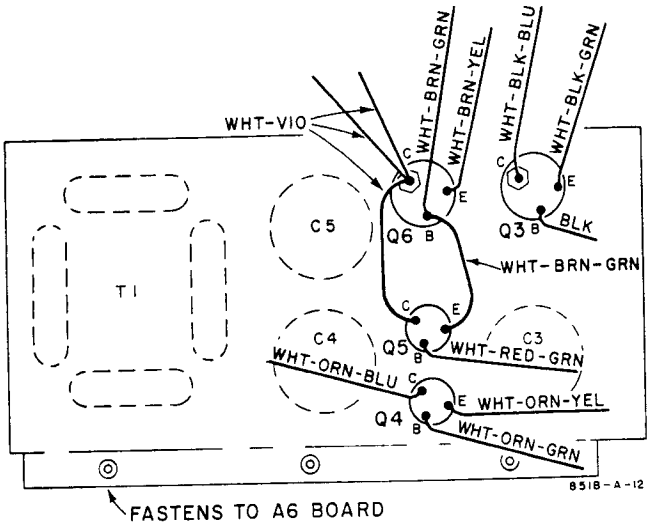


Figure 5-15. Under Side of Transistor/ Transformer Deck, Identification of Q3-Q6 Terminals

5-152. REMOVING BANDPASS FILTER ASSEMBLY A12.

5-153. A12 components are mounted on a Board inside the casting; see Figure 5-19. To free A12, proceed as follows:

a. Rest 851 on left side, and remove top and right-side covers.

b. Disconnect cable from A12J1 (Figure 5-13).

c. Remove two screws (9) which hold A12 to the side casting; these are 6-32 x 3/8 FH machine screws with integral lockwashers.

d. Lift A12 free of the mounting recess and turn it over so top cover can be removed.

e. Remove four screws which hold top cover on; these are 4-40 x 1/4 RH machine screws with integral lockwashers.

5-154. REMOVING SWITCHES.

5-155. Larger knobs secure to the shaft with an 8-32 x 3/16 setscrew which is loosened with a No. 8 allen wrench. The red verniers secure to the shaft with a 6-32 x 1/8 setscrew; loosen with a No. 6 allen wrench. Each shaft is secured to the panel with a 3/8-32 x 1/2 hex nut which takes a 1/2" wrench.

5-156. REMOVING ASSEMBLIES A3 AND A5.

5-157. To reach 100KC Bandpass Filter Assembly A3 or A5:

a. Remove 851 top cover.

b. A3 and A5 are beneath the LV Power Supply A9 Board (see Figure 5-10), and some of the cabling is beneath the Transformer/Transistor Deck. The A9 Board and the Deck lift as one piece; free them as described in Paragraph 5-149.

c. Disconnect the two cables connected to the Filter Assembly of interest, and remove the four screws which attach the Assembly to the bottom of the A2 casting. Assembly A3 is fastened with three 6-32 x 3/8 BH machine screws with integral lockwasher and one 6-32 x 1/2 BH machine screw with lockwasher (this screw also secures a 3-terminal tie point to the casting). Assembly A5 is fastened with four 6-32 x 3/8 BH machine screws with integral lockwasher.

5-158. ETCHED CIRCUITS.

5-159. The etched circuit boards in the 851 Spectrum Analyzer Display Section are of the plated-through type consisting of metallic conductors bonded to both sides of insulating material. The metallic conductors are extended through the component mounting holes by a plating process. Soldering can be done from either side of the board with equally good results. Table 5-23E lists recommended tools and materials. Following are recommendations and precautions pertinent to etched circuit repair work.

a. Avoid unnecessary component substitution: it can result in damage to the circuit board and/or adjacent components.

b. Do not use a high-power soldering iron on etched circuit boards. Excessive heat may lift a conductor or damage the board.

c. Use a suction device (Table 23E) or wooden toothpick to remove solder from component mounting holes. DO NOT USE A SHARP METAL OBJECT SUCH AS AN AWL OR TWIST DRILL FOR THIS PURPOSE. SHARP OBJECTS MAY DAMAGE THE PLATED-THROUGH CONDUCTOR.

d. After soldering, remove excess flux from the soldered areas and apply a protective coating to prevent contamination and corrosion. See Table 5-23E for recommendations.

5-160. TRANSISTOR REPLACEMENT.

a. Do not apply excessive heat; see Table 5-23E for recommended soldering tools.

b. Use long-nose pliers between transistor and hot soldering iron as a heat sink. The instant solder is melted, use pliers to pull lead free of Board.

c. When installing replacement transistor, ensure sufficient lead length to dissipate soldering heat by using about the same length of exposed lead as used for original transistor.

5-161. COMPONENT REPLACEMENT.

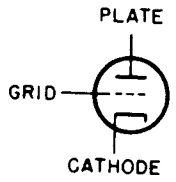
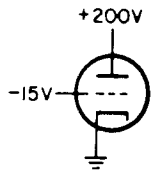
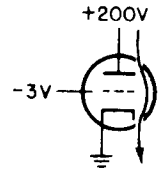
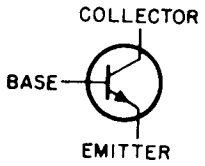
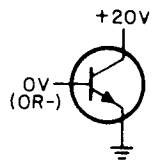
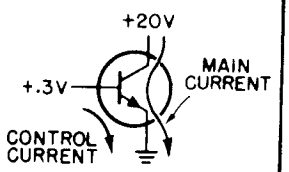
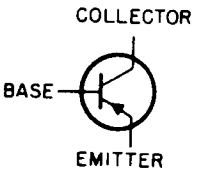
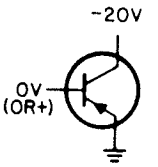
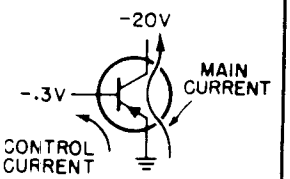
a. Remove defective component from Board.

Note

Axial lead components, such as resistors and tubular capacitors, can be replaced without unsoldering. Clip leads near body of defective component, remove component and straighten leads left in board. Wrap leads of replacement component one turn around original leads. Solder wrapped connection, and clip off excess lead.

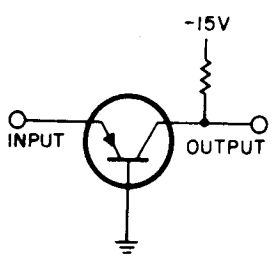
b. If component was unsoldered, remove solder from mounting holes with a suction desoldering aid (Table 5-23E) or wooden toothpick.

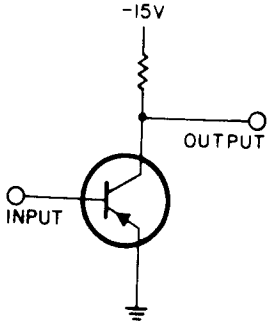
A. TRANSISTOR BIASING

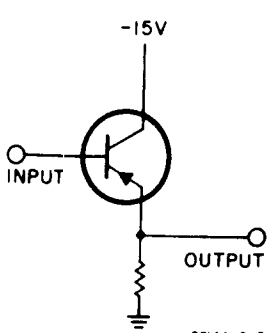
DEVICE	SYMBOL	CUT OFF	CONDUCTING
VACUUM TUBE			
NPN TRANSISTOR			
PNP TRANSISTOR			

B. AMPLIFIER CHARACTERISTICS

CHARACTERISTIC	COMMON BASE	COMMON EMITTER	COMMON COLLECTOR
INPUT Z	30-50 Ω	500-1500 Ω	20-500K Ω
OUTPUT Z	300-500K Ω	30-50K Ω	50-1000 Ω
VOLTAGE GAIN	500-1500	300-1000	< 1
CURRENT GAIN	< 1	25-50	25-50
POWER GAIN	20-30 db	25-40 db	10-20 db







9614A-8-8

Figure 5-16. Transistor Biasing and Typical Amplifier Characteristics

Table 5-23E. Etched Circuit Soldering Equipment

Item	Use	Specification	Item Recommended
Soldering tool	Soldering Unsoldering	Wattage rating: 47-1/2 - 56-1/2 Tip Temp: 850 - 900°	Ungar #776 Handle with *Ungar #4037 Heating Unit
Soldering *Tip	Soldering Unsoldering	*Shape: pointed	*Ungar #PL111
De-soldering aid	To remove molten solder from connection	Suction device	Soldapullt by Edsyn Co. Arleta, California
Resin (flux) solvent	Remove excess flux from soldered area before application of protective coating	Must not dissolve etched circuit base board material or conductor bonding agent	Freon Acetone Lacquer Thinner Isopropyl Alcohol (100% dry)
Solder	Component replacement Circuit board repair Wiring	Resin (flux) core, high tin content (60/40 tin/lead), 18 gauge (SWG) preferred	
Protective coating	Contamination, corrosion protection after soldering	Good electrical insulation, corrosion-prevention properties	Krylon ® #1302 Humiseal Protective Coating, Type 1B12 by Columbia Technical Corp. Woodside 77, New York
*For working on 851 Boards: for general purpose work, use Ungar #1237 Heating Unit (37.5W, tip temp of 750-800°) and Ungar #PL113 1/8" chisel tip. **Krylon, Inc., Norristown, Pennsylvania			

c. Shape leads of replacement component to match mounting hole spacing.

d. Insert component leads into mounting holes, and position component as original was positioned. DO NOT FORCE LEADS INTO MOUNTING HOLES; sharp lead ends may damage plated-through conductor.

5-162. ETCHED CONDUCTOR REPAIR. A broken or burned section of conductor can be repaired by bridging the damaged section with a length of tinned copper wire. Allow adequate overlap and remove any varnish from etched conductor before soldering wire into place.

5-163. TRANSISTORS.

5-164. The following general information is provided for those who may not have had extensive experience with transistors.

5-165. In transistor testing the most important consideration is the base-emitter junction; like the control grid of a vacuum tube, this is the operational control point in the transistor. This junction is essentially a solid-state diode, and for the transistor to conduct this diode must be forward-biased.

5-166. The transistor symbol (see Figure 5-16) can be used to determine the polarity required to forward-bias the base-emitter junction. Remember that the base material is the middle letter of the transistor type (NPN or PNP). Referring to part A of Figure 5-16, notice that the emitter arrow points toward the N-type material. Thus when the arrow points away from the base (NPN), the base must be positive with respect to the emitter to forward-bias the junction, and when the arrow points toward the base (PNP), the base must be negative with respect to the emitter to forward-bias the junction.

5-167. Bias polarity for cutoff and conduction for vacuum tubes as well as transistors is also shown in part A of Figure 5-16. Part B shows simplified versions of the three basic transistor circuits, and gives the amplifier characteristics of each.

Table 5-24. Connections, RF Circuit Assembly A2, Boards A2A1 through A2A5

Ref No.	Color Code	Connection	Fig. Ref
A2A1 Board (00851-6025) Input Switching Circuit			
1		20MC input; from A2J1, which accepts cable A1W2 from I. F. GAIN Assy A1	5-20
2	wht-blk-orn	Output, 1MC I. F. bandwidth path; to Output Switching Circuit A2A5, point 30	5-24
3	wht-red-yel	-24VDC input at A to A2A1K1, from point 28, A2A5 board	
4	wht-red-grn	-24VDC input at B to A2A1K2; from point 26, A2A5	
5	coax	Output, 100KC I. F. bandwidth path; to 100KC Bandpass Filter A3 (on rear of casting)	
6	wht	Output, 1-10KC I. F. bandwidth paths; to point 11, 1st 1-10KC BP Flt and Ampl Assy A2A3	
A2A2 Board (00851-6022) 20MC Amplifier			
7	coax	Input 100KC I. F. bandwidth path from 100KC Filter A3, via cable A2W2	5-24
8	coax	Output, 100KC I. F. bandwidth path; to 100KC Filter A5, via cable A2W3	5-24
9	vio	-15VF supply, input; from LV Pwr Supply A9 via A2C1	5-37
10	wht-vio	-15VF supply, output; to Current-Controlled Attenuator A2A6, point 4	5-27
A2A3 Board (00851-6023) 1st 1-10KC BP Flt and Ampl Assy			
11	wht	Input, 1-10KC I. F. bandwidth paths; from point 6, A2A1 Assembly	5-24
12	wht-brn-vio	-24VDC input at C to A2A3K1; from point 20, 2nd 1-10KC BP Flt and Ampl Assy A2A4	
13	wht-blk-vio	-24VDC input at D to A2A3K2; from point 19, A2A4 board	
14	vio	-15VF supply, input; via point 17, A2A4 board	
15	wht	Output, 1-10KC I. F. bandwidth paths; to point 16, A2A4 board	
A2A4 Board (00851-6024) 2nd 1-10KC BP Flt and Ampl Assy			
16	wht	Input, 1-10KC I. F. bandwidth paths; from point 15, A2A3 board	5-24
17	vio	-15VF supply output to point 14, A2A3 board	5-24
18	wht-orn-blu	-24VDC supply for relay A2A4K1; incoming at E via network A2Z2 and I. F. BANDWIDTH switch	5-24 5-38
19	wht-blk-vio	-24VDC supply outgoing to relay A2A3K2	5-24
20	wht-brn-vio	-24VDC supply outgoing to relay A2A3K1	5-24
21	wht	Output, 1-10KC I. F. bandwidth paths; to point 24, A2A5 Output Switching Circuit board	5-24
22	wht-orn-yel	-24VDC supply for relay A2A4K2; incoming at F via network A2Z3 and I. F. BANDWIDTH switch	5-24 5-38
23	vio	-15VF supply, input; via A2Z1 network and LC filter on rear of A2 casting; from LV Pwr Supply A9	5-37
A2A5 Board (00851-6026) Output Switching Circuit Assy			
24	wht	Input, 1-10KC I. F. bandwidth paths; from point 21, A2A4 board	5-24
25	wht-orn-vio	-24VDC supply for relay A2A5K1; incoming at G via network A2Z4 and I. F. BANDWIDTH switch	5-24 5-38
26	wht-red-grn	-24VDC supply outgoing to relay A2A1K2	5-24
27	coax	Input, 100KC I. F. bandwidth path; from 100KC BP Flt A5, via cable A2W4	5-24

Table 5-24. Connections, RF Circuit Assembly A2, Boards A2A1 through A2A5 (cont'd)

Ref No.	Color Code	Connection	Fig. Ref
A2A5 Board (00851-6026) Output Switching Circuit Assy (cont'd)			
28	wht-red-yel	-24VDC supply outgoing to relay A2A1K1	5-24
29	wht-orn-grn	-24VDC supply for relay A2A5K2; incoming at H via network A2Z5 and I. F. BANDWIDTH switch	5-24 5-38
30	wht-blk-orn	Input, 1MC I. F. bandwidth path; incoming from point 2 on A2A1 board	5-24
31	wht-red-blu	Output, I. F. bandwidth switching circuits; to A2A6 Current-Controlled Attenuator input	5-27

Table 5-24A. Connections, RF Circuit Assembly A2, Boards A2A6, A2A7

Ref No.	Color Code	Connection	Fig. Ref
A2A6 Board (00851-6021) Current-Controlled Attenuator			
1	wht-red-blu	20MC input; from output of I. F. bandwidth switching circuits, point 31, A2A5 board	5-24
2	coax	Control-current input; from VERT DISPLAY switch via cable A2W5	5-27
3	wht-blk-blu	20MC output, to 20MC I. F. Amplifier (point 5 on A2A7 board)	5-27
4	wht-vio	-15VF supply; from point 10, A2A2 board	5-24
A2A7 Board (00851-6020) 20MC I. F. Amplifier Assy			
5	wht-blk-blu	20MC input; from point 3, A2A6 board	5-27
6	coax	Connection to I. F. VERNIER, through feed-through capacitor A2C6 via cable A2W7	
7		-15VF supply; incoming via feed-through capacitor A2C3	
8		Connection to connector J5, I. F. TEST POINT, on rear panel; capacitor A2C2 is in the line to J5.	
9		+15VDC supply; incoming via feed-through capacitor A2C4 and resistor A2R1	
10	coax	Video output; to Vertical Amplifier A7 via cable A2W6	5-29

Table 5-25. Waveform Chart, Model 851 Spectrum Analyzer Display Section (cont'd)

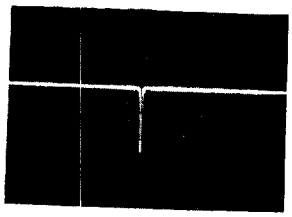
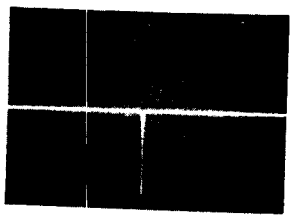
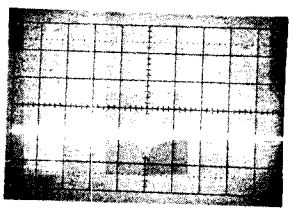
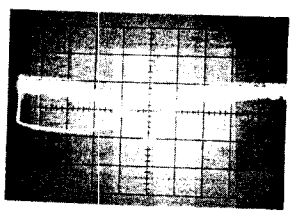
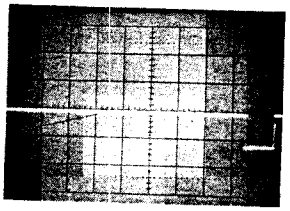
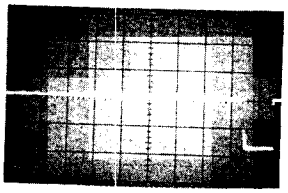
	Analyzer Condition	Test Point	Test Oscilloscope Sensitivity and Sweep Speed	Waveform
	VERT DISPLAY SWITCH AND 20MC IF AMPL			
	I. F. BANDWIDTH...3KC SWEEP TIME...3MS/CM Input signal...CW			
1	VERT DISPLAY...SQ Display signal amplitude...1.4	Base, A11Q2	2 v/cm 5 ms/cm Ext sync, from 851 HORIZ OUTPUT	
2	VERT DISPLAY...SQ Displayed signal amplitude...1.4	Emitter, A11Q2	0.2 v/cm 5 ms/cm Ext sync, from 851 HORIZ OUTPUT	
3	VERT DISPLAY...LOG Displayed signal amplitude...60DB	I. F. Test Point	50 mv/cm Sweep from 851 HORIZ OUTPUT	
4	VERT DISPLAY...LOG Displayed signal amplitude...60DB	Base, A2A7Q4	2 v/cm Sweep from 851 HORIZ OUTPUT	
	851 VERTICAL AMPLIFIER			
	SYNC.....INT I. F. BANDWIDTH...1KC SPECTRUM WIDTH..10KC/CM SWEEP TIME.....3MS/CM Input signal....CW			
5		Input to A7R6 (blanking voltage)	10 v/cm 10 ms/cm	
6		Base, A7Q5 (blanking voltage)	50 v/cm 10 ms/cm	

Table 5-25. Waveform Chart, Model 851 Spectrum Analyzer Display Section (cont'd)

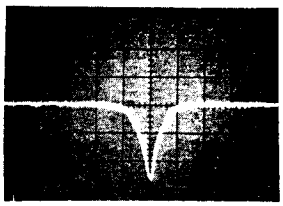
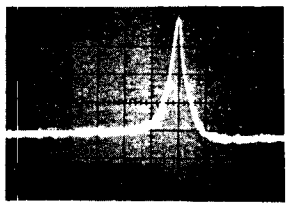
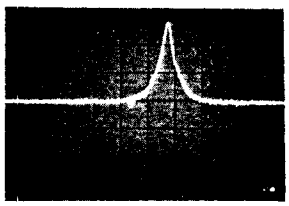
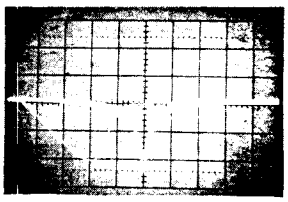
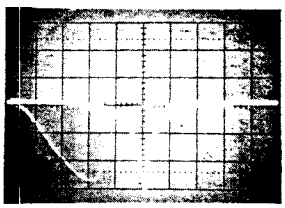
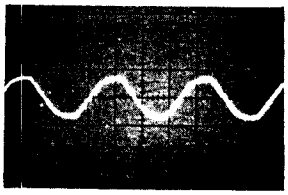
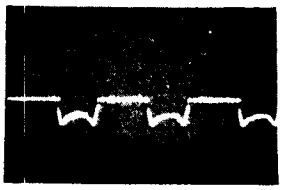
Analyzer Condition	Test Point	Test Oscilloscope Sensitivity and Sweep Speed	Waveform
851 VERTICAL AMPLIFIER (cont'd)			
SYNC ..... INT I. F. BANDWIDTH..1KC SPEC WIDTH.....10KC/CM SWEEP TIME.... 3MS/CM Input signal..... CW			
7	Base, A7Q8 (video)	1 v/cm 10 ms/cm	
8	Collector, A7Q8	50 mv/cm 10 ms/cm	
9	Collector, A7Q7	10 v/cm 10 ms/cm	
10	Collector, A7Q9	0.1 v/cm Sweep from 851A HORIZ OUTPUT	
11	Collector, A7Q6	10 v/cm Sweep from 851A HORIZ OUTPUT	
Unless otherwise specified: SYNC..... LINE SWEEP TIME..3MS/CM	**SWEEP & HORIZ AMPLIFIER**		
12	Base, A6Q1	10 v/cm 5 ms/cm	
13	Collector, A6Q1	10 v/cm 5 ms/cm	

Table 5-25. Waveform Chart, Model 851 Spectrum Analyzer Display Section (cont'd)

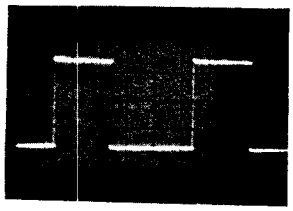
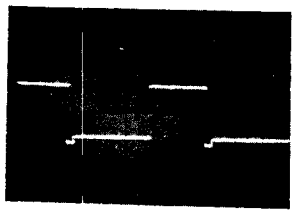
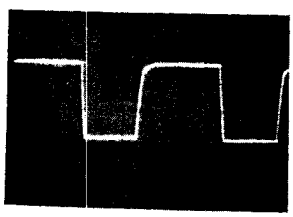
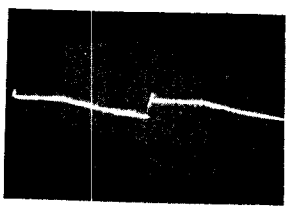
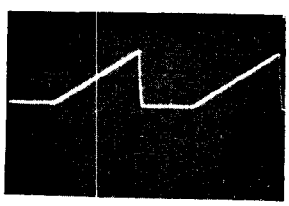
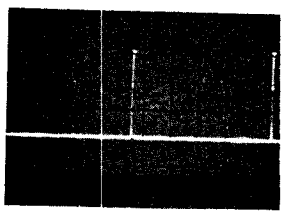
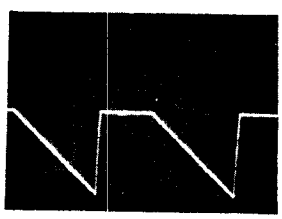
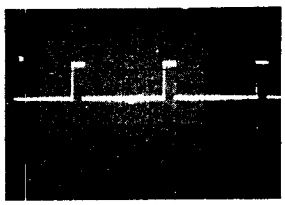
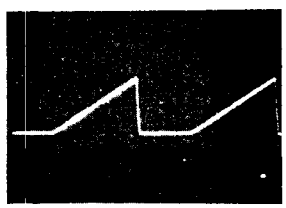
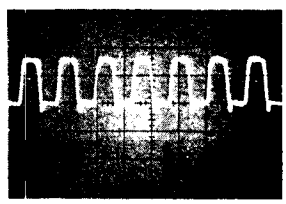
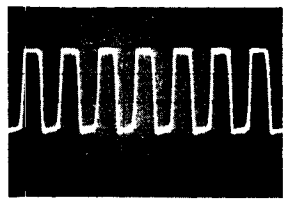
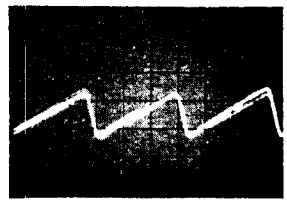
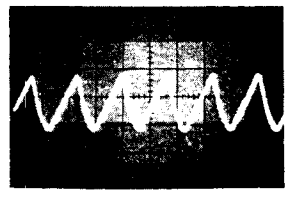
Analyzer Condition	Test Point	Test Oscilloscope Sensitivity and Sweep Speed	Waveform
SWEEP & HORIZ AMPLIFIER (cont'd)			
SYNC..... LINE SWEEP TIME..3MS/CM			
14	Base, A6Q7	2 v/cm 10 ms/cm	
15	Base, A6Q9	2 v/cm 10 ms/cm	
16	Base, A6Q15	5 v/cm 10 ms/cm	
17	Collector, A6Q12	0.5 v/cm 10 ms/cm	
18	Emitter, A6Q14	5 v/cm 10 ms/cm	
19	Connector, A6Q3	5 v/cm 10 ms/cm	
20	Collector, A6Q16	20 v/cm 10 ms/cm	

Table 5-25. Waveform Chart, Model 851 Spectrum Analyzer Display Section (cont'd)

	Analyzer Condition	Test Point	Test Oscilloscope Sensitivity and Sweep Speed	Waveform
	SWEEP & HORIZ AMPLIFIER (cont'd)			
21	SYNC ..... LINE SWEEP TIME...3MS/CM	Collector, A6Q17	20 v/cm 10 ms/cm	
22	SYNC..... INT SWEEP TIME...3MS/CM	Base, A6Q7	5 v/cm 10 ms/cm	
23	SYNC..... INT SWEEP TIME...3MS/CM	Collector, A6Q5	5 v/cm 10 ms/cm	
24		Collector, A6Q13	5 v/cm 10 ms/cm	
	HIGH-VOLTAGE SUPPLY AND CRT			
25		Base, Q1 Q2	5 v/cm 10 μs/cm	
26		Collector, Q1 Q2	10 v/cm 50 μs/cm	
	LOW-VOLTAGE POWER SUPPLY			
27		Junction, A9R1 A9R2	2 v/cm 5 ms/cm	
28		Collector, A9Q1	5 v/cm 5 ms/cm	

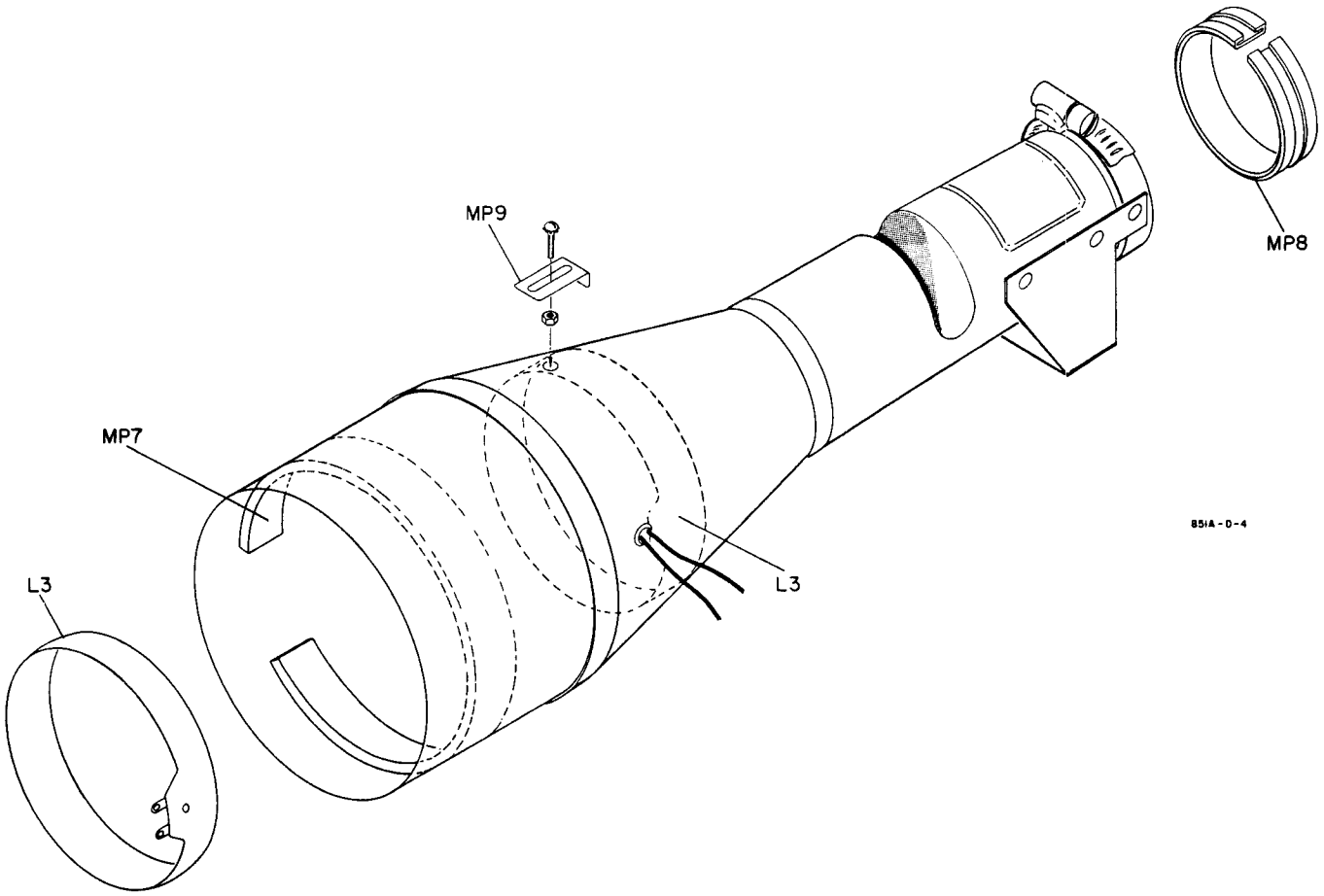
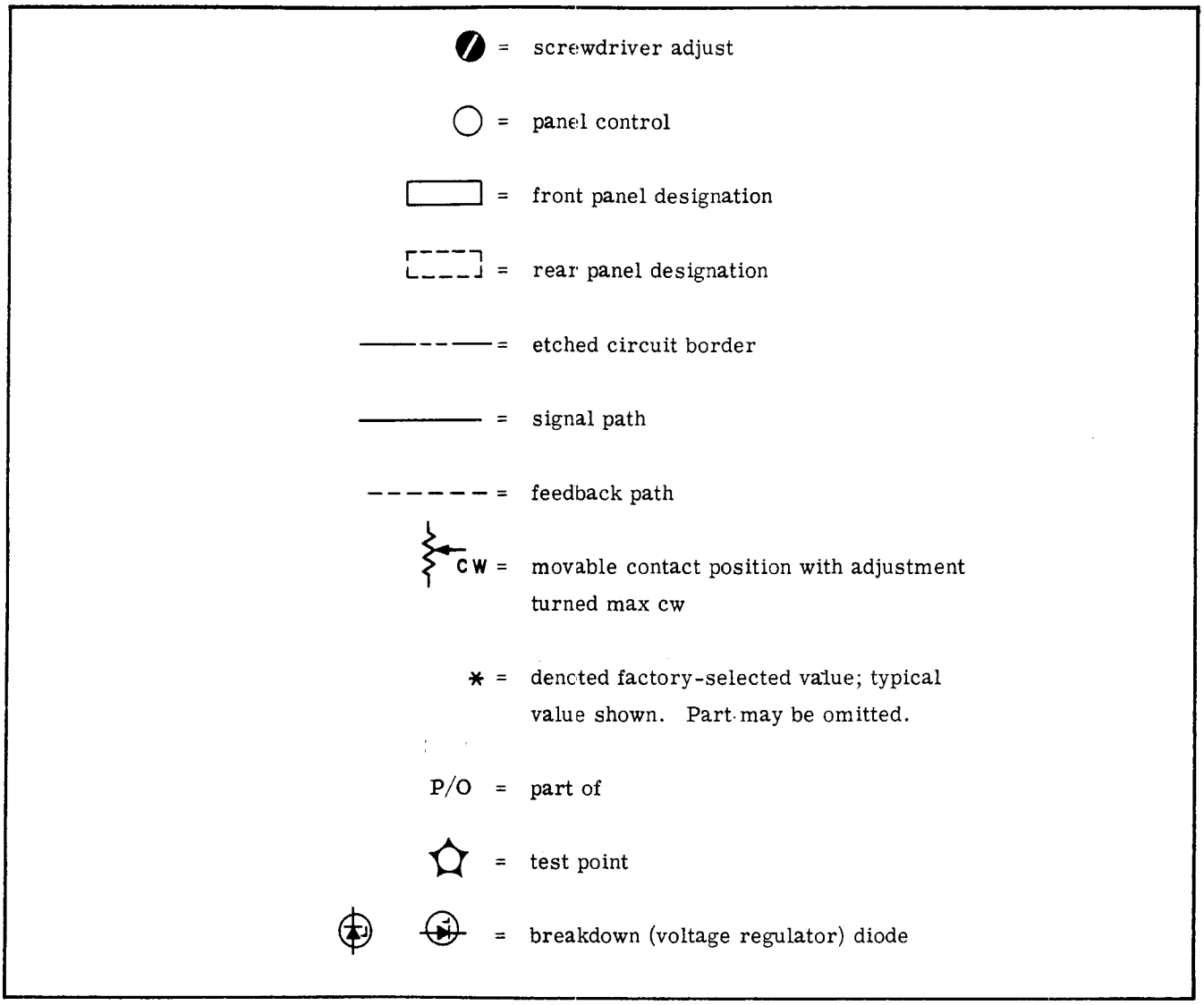
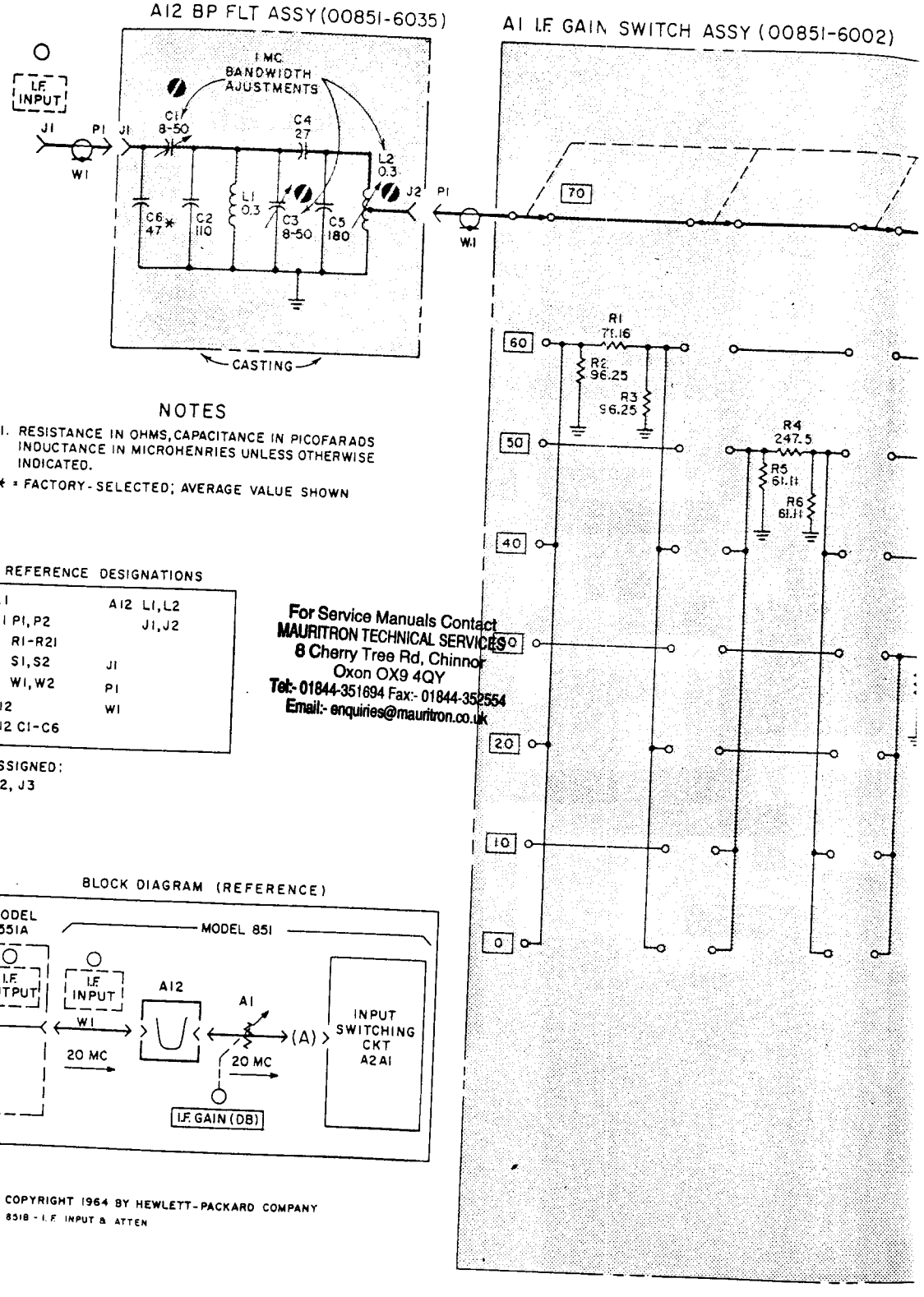


Figure 5-17. CRT Shield Assembly, Parts Identification

Table 5-25A. Symbols Used on Schematic Diagrams





NOTES

1. RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS INDUCTANCE IN MICROHENRIES UNLESS OTHERWISE INDICATED.

* = FACTORY-SELECTED; AVERAGE VALUE SHOWN

REFERENCE DESIGNATIONS

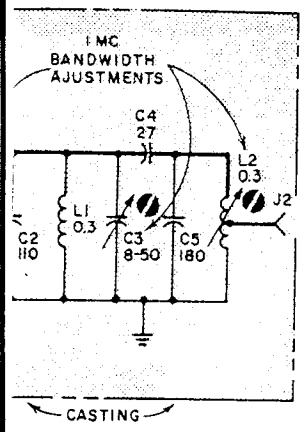
A1	A12 L1, L2
A1 P1, P2	J1, J2
R1-R21	
S1, S2	J1
W1, W2	P1
A12	W1
A12 C1-C6	

UNASSIGNED:
J2, J3

BLOCK DIAGRAM (REFERENCE)

8518 - I.F. INPUT & ATTEN

3P FLT ASSY(00851-6035)



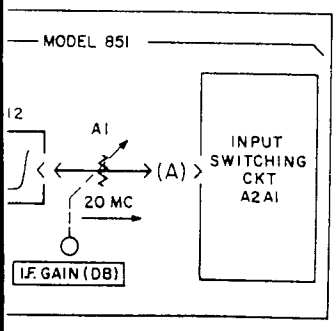
TES

APACITANCE IN PICOFARADS
ENRIES UNLESS OTHERWISE

AVERAGE VALUE SHOWN

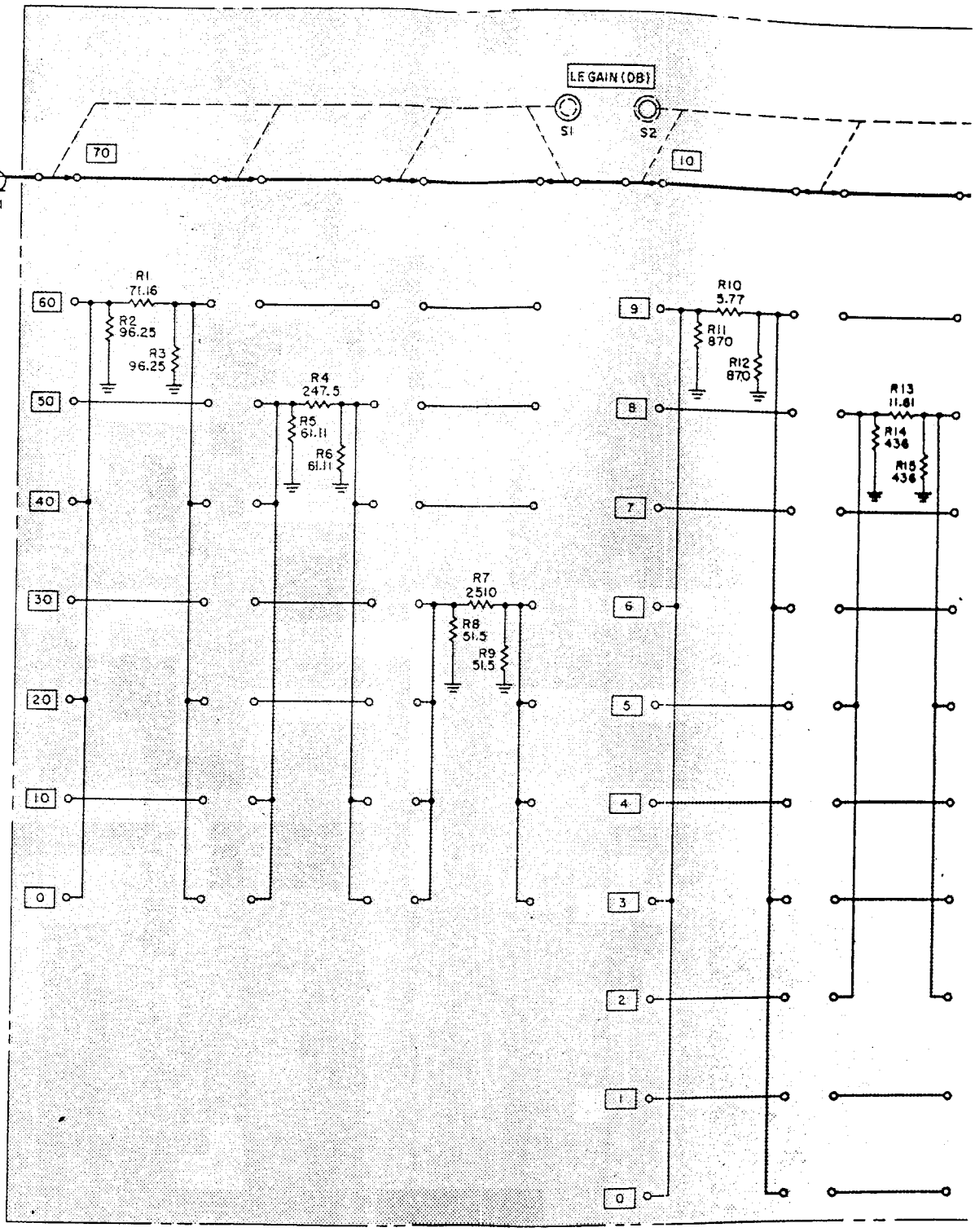
NS

RAM (REFERENCE)



ETT-PACKARD COMPANY

A1 I.F. GAIN SWITCH ASSY (00851-6002)



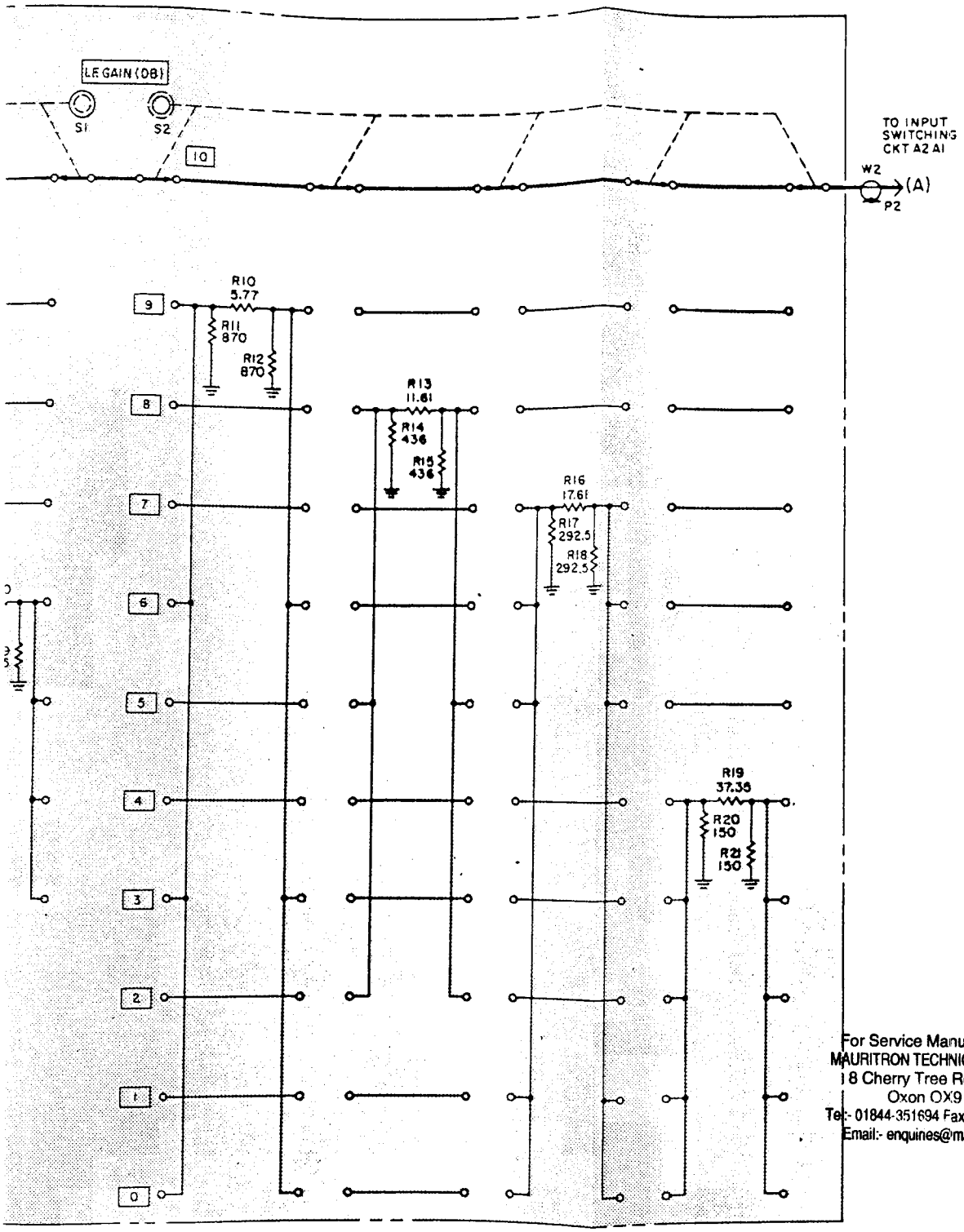


Figure 5-20. 20MC I. F. Input and Attenuator Schematics, 851B

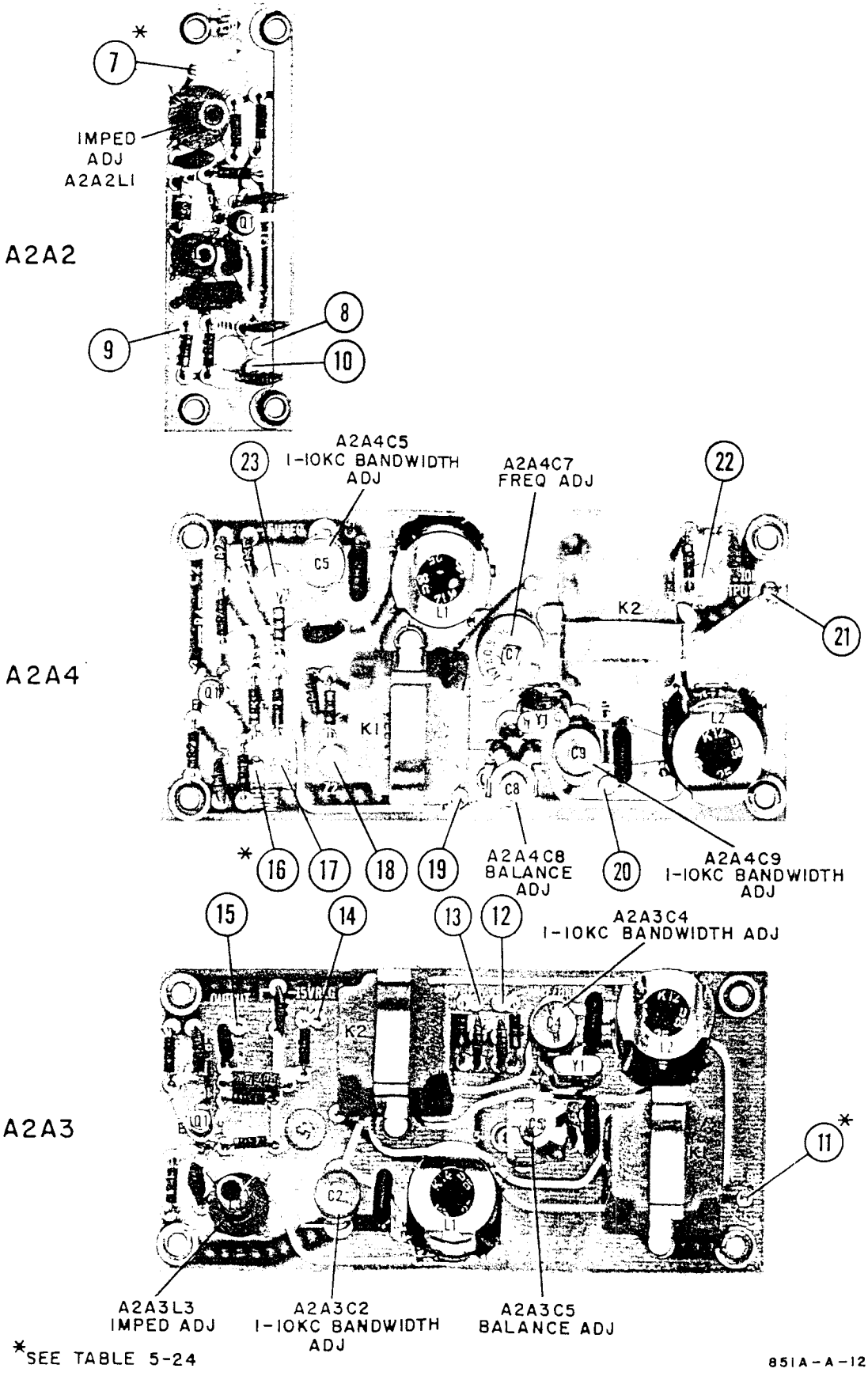


Figure 5-21. RF Circuit Assembly Boards A2A2, A2A3, A2A4

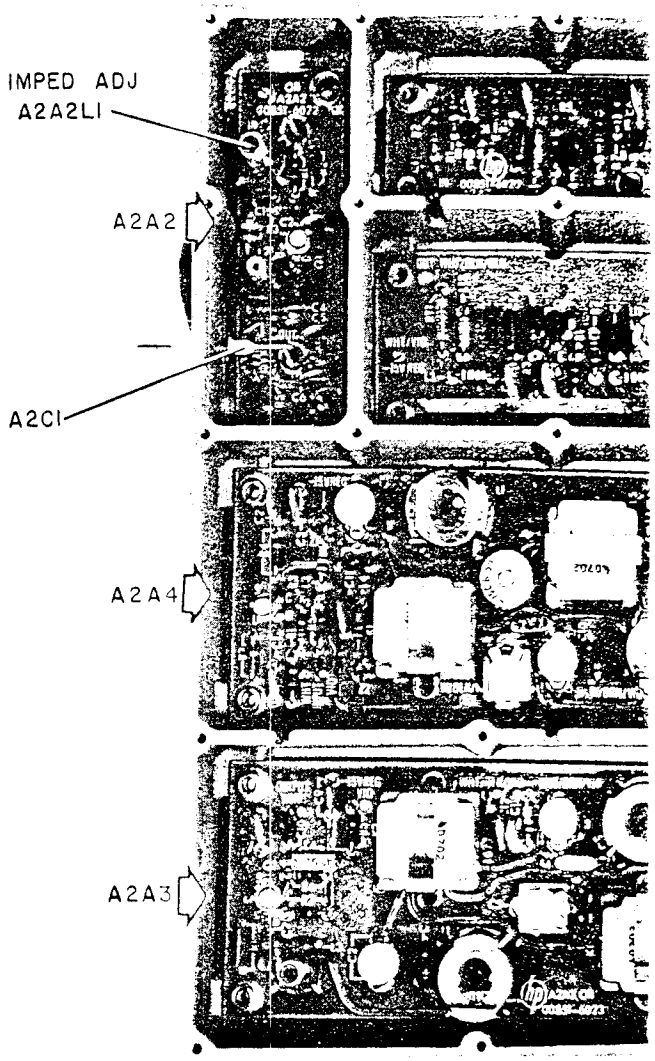
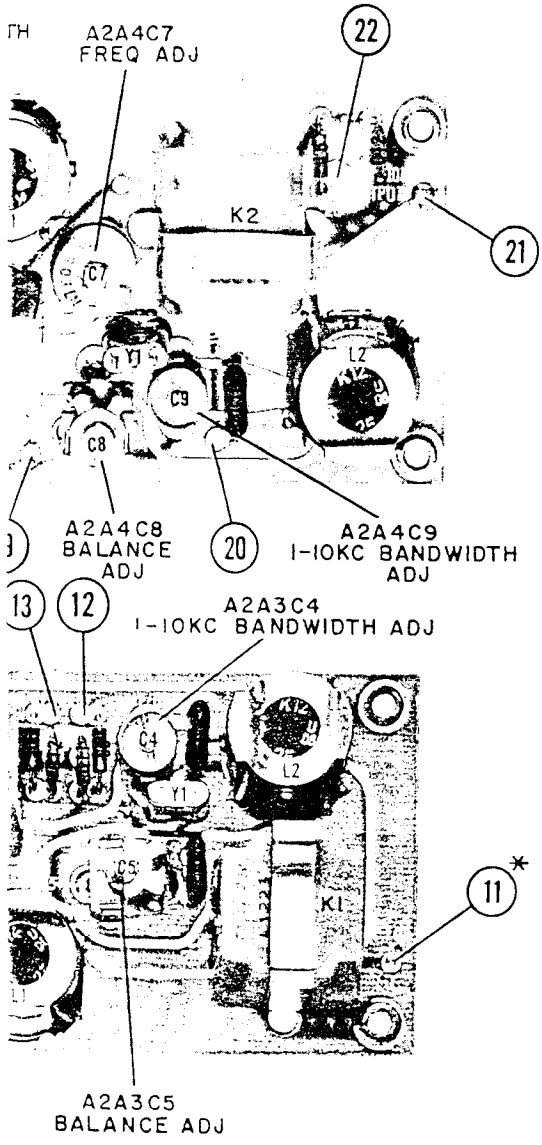
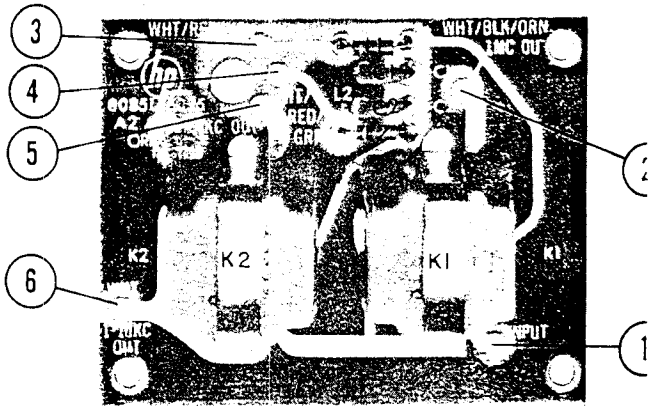


Figure 5-22. RF Circuit Ass



A2A1



SEE TABLE 5-24

bly Boards A2A2, A2A3, A2A4

Figure 5-21

Figure 5-23. RF Circuit As

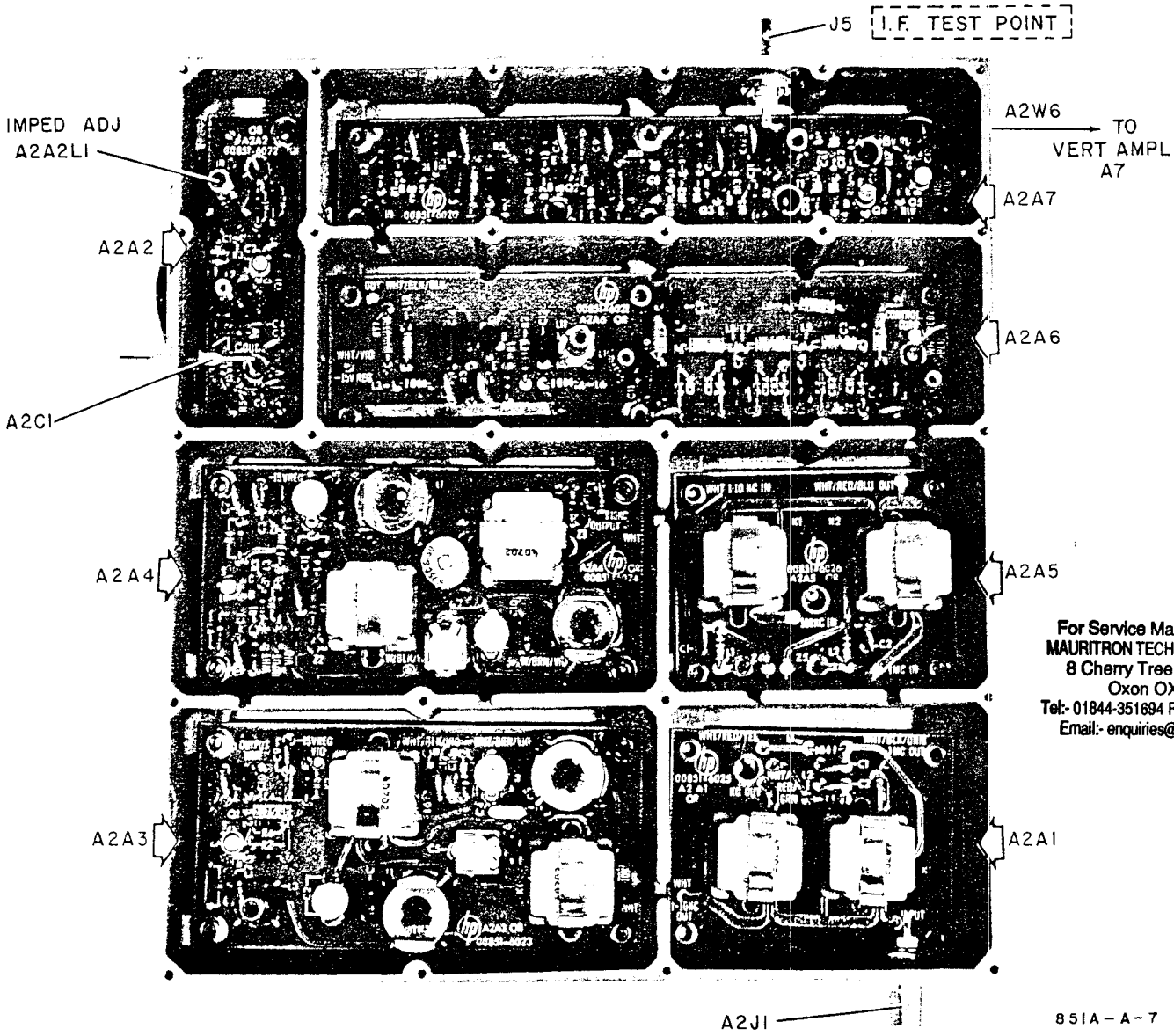
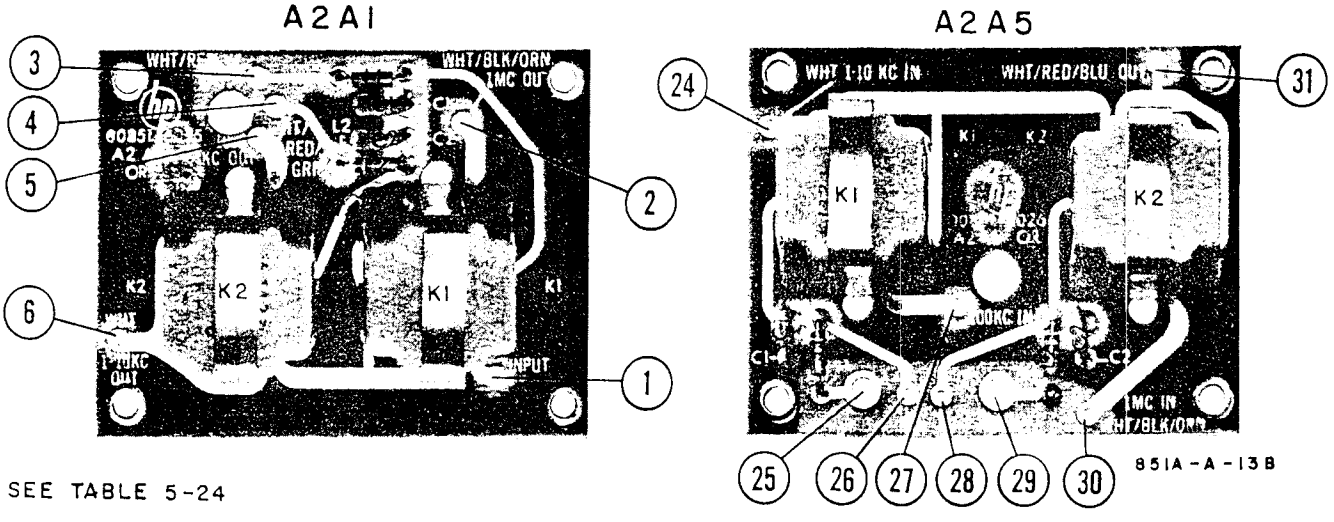


Figure 5-22. RF Circuit Assembly A2, Top Cover Removed



SEE TABLE 5-24

Figure 5-21

Figure 5-23. RF Circuit Assembly Boards A2A5 and A2A1

NOTES:

1. RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS, INDUCTANCE IN MICROHENRIES, UNLESS OTHERWISE NOTED.
2. RELAYS SHOWN DE-ENERGIZED (I.F. BANDWIDTH AT 10KC)
3. VF = FILTERED VOLTAGE (SEE LV PWR SUPPLY DIAG)

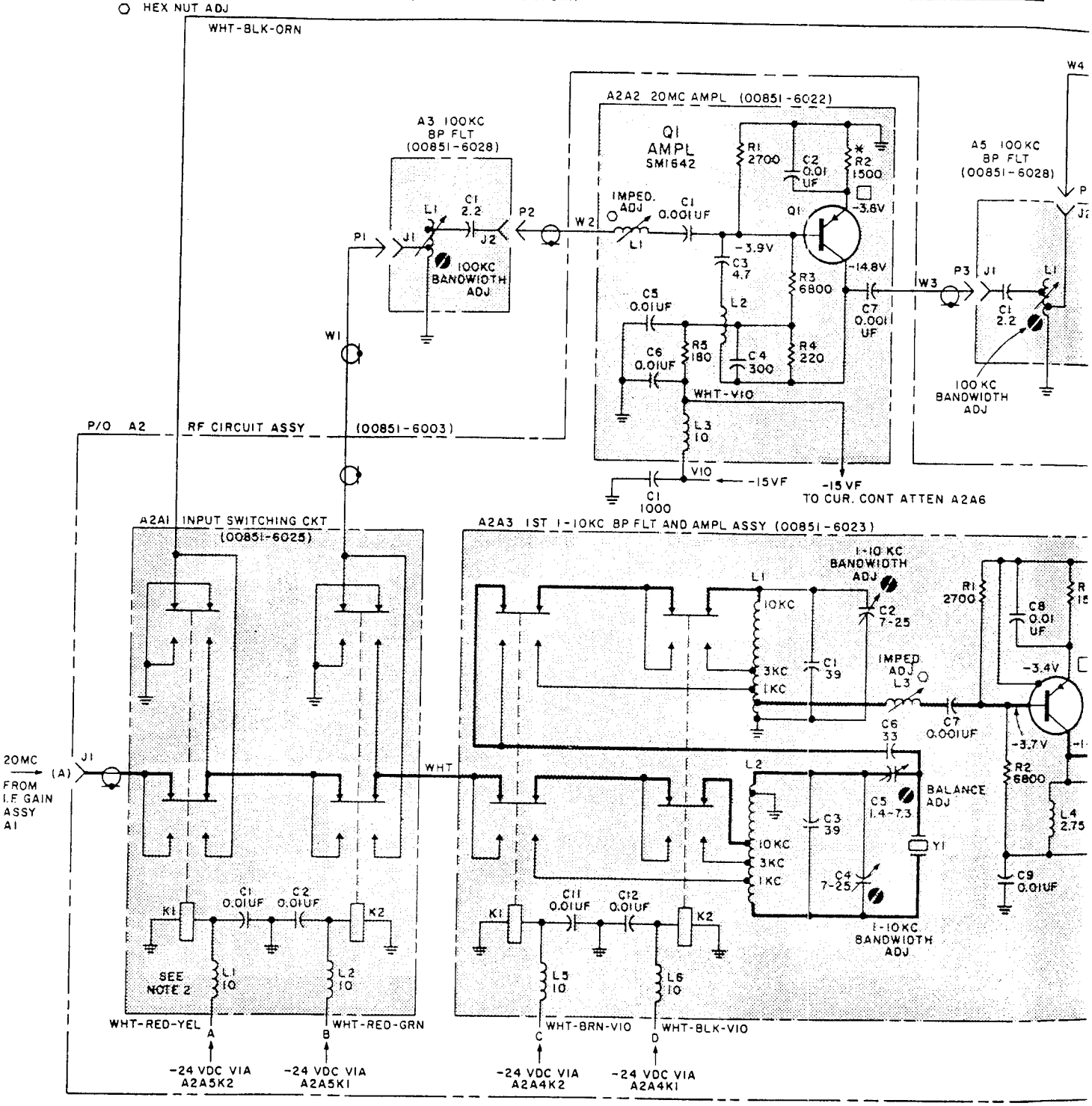
★ A4S1 = I.F. BANDWIDTH SWITCH, SEE SWITCH DETAIL, FIG. 5-38

□ VOLTAGES MEASURED WITH -*hp*-410C ELECTRONIC VOLTMETER 100 MEGOHMS INPUT RESISTANCE

* OPTIMUM VALUE SELECTED AT FACTORY, AVERAGE VALUE SHOWN

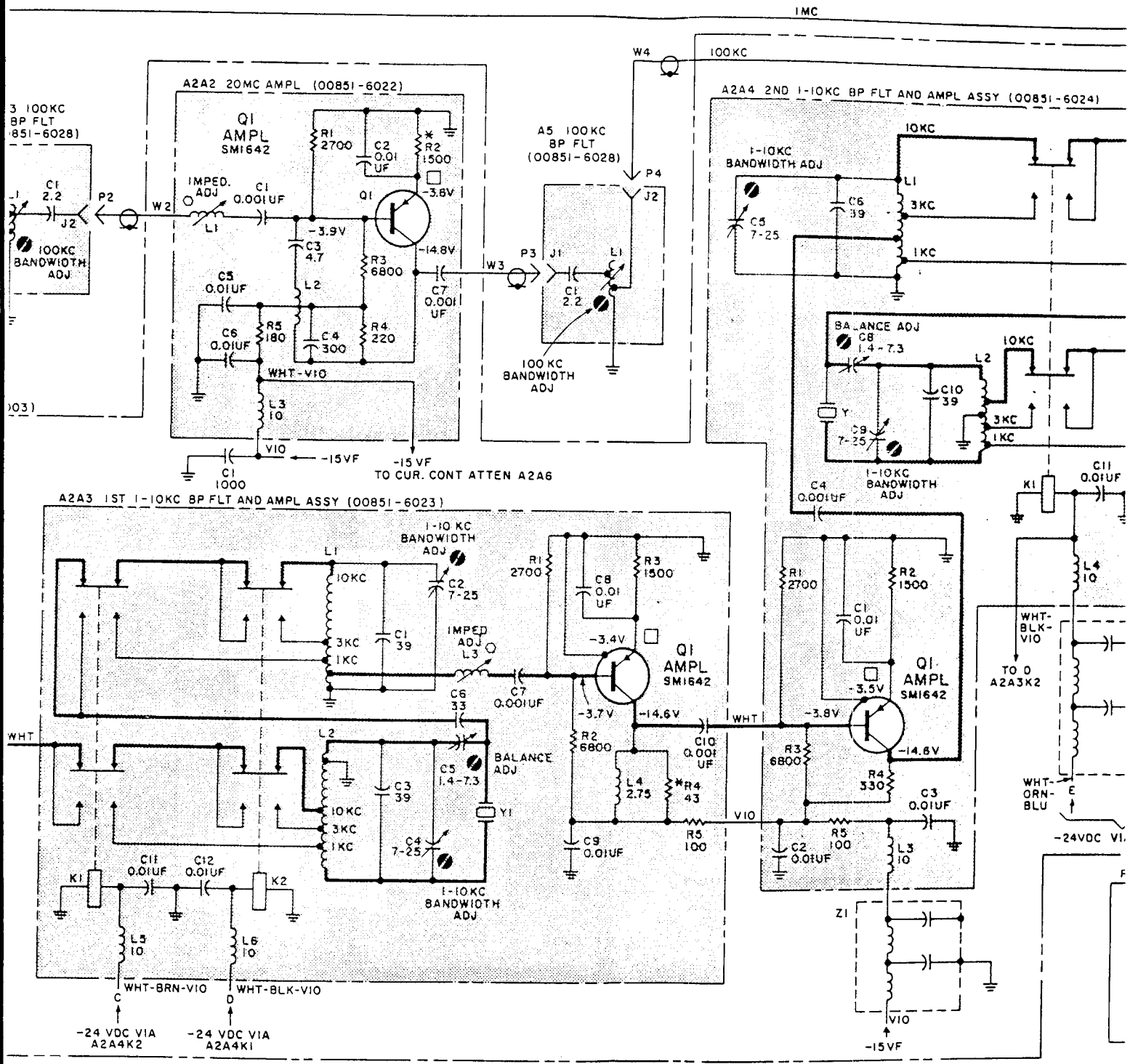
○ HEX NUT ADJ

I.F. BANDWIDTH POSITION	RELAY ENERGIZED
1MC	A2A1K1 & A2A5K2
100KC	A2A1K2 & A2A5K1
10KC	NONE
3KC	A2A3K2 & A2A4K1
1KC	A2A3K1 & A2A4K2



COFARADS,
THERWISE NOTED.
DWIDTH AT 10KC)
PPLY DIAG)
VITCH DETAIL, FIG. 5-38
ECTRONIC
ANCE
VERAGE VALUE SHOWN

I.F. BANDWIDTH POSITION	RELAY ENERGIZED
1MC	A2A1K1 & A2A5K2
100KC	A2A1K2 & A2A5K1
10KC	NONE
3KC	A2A3K2 & A2A4K1
1KC	A2A3K1 & A2A4K2



REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMBLY DESIGNATION AS PREFIX TO FORM COMPLETE DESIGNATION. e.g., R1 OF ASSEMBLY A1 IS A1R1, AND IS LISTED A1R1 IN THE TABLE OF REPLACEABLE PARTS. DESIGNATIONS OF COMPONENTS NOT WITHIN ASSEMBLIES ARE COMPLETE AS SHOWN.

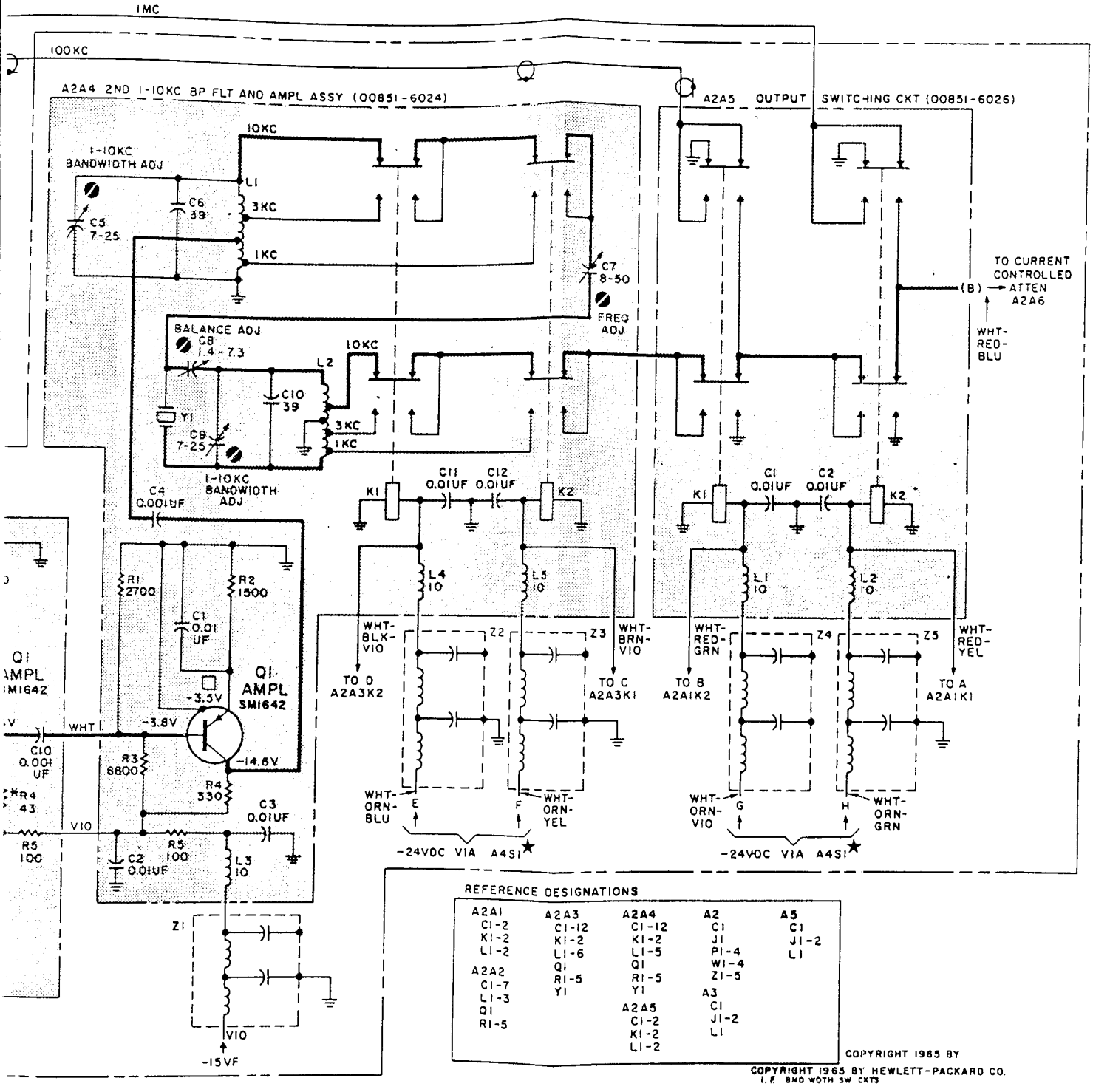
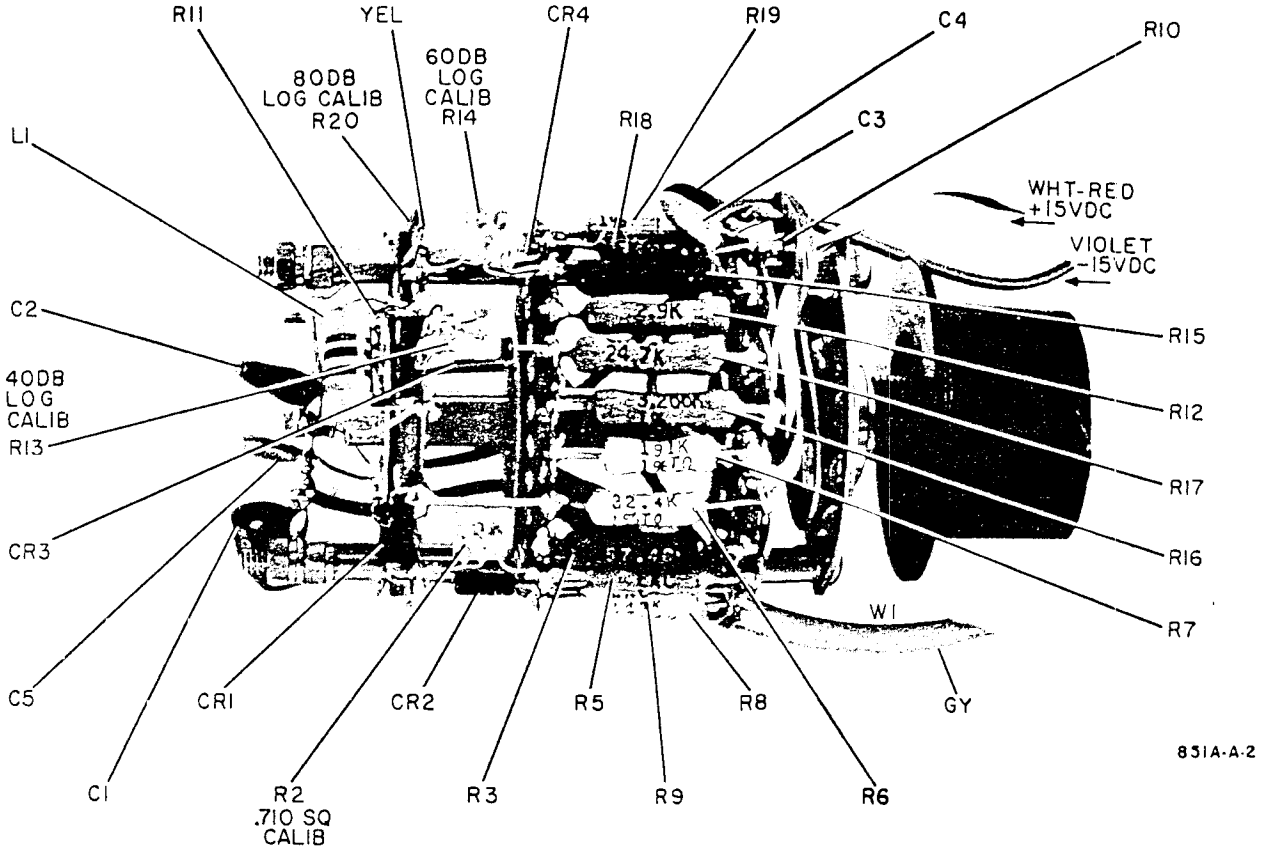


Figure 5-24. I. F. Bandwidth Switching Circuits, 851B



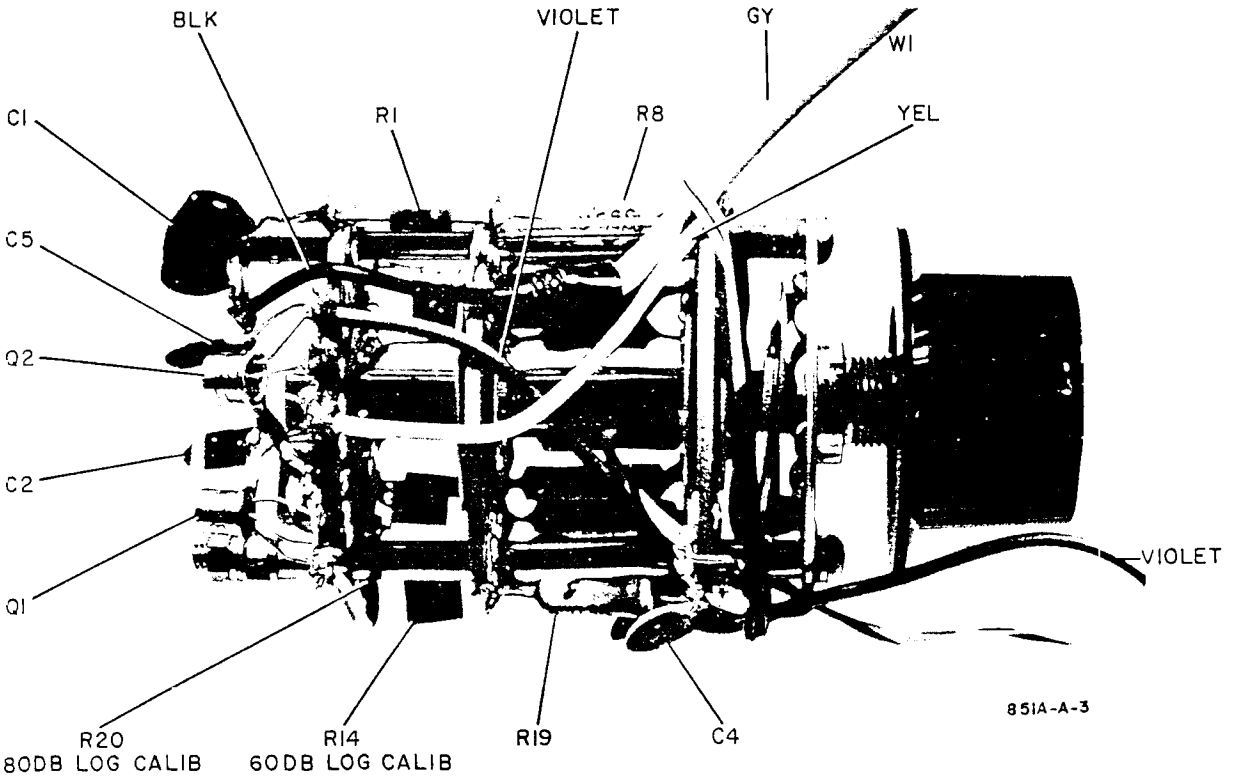
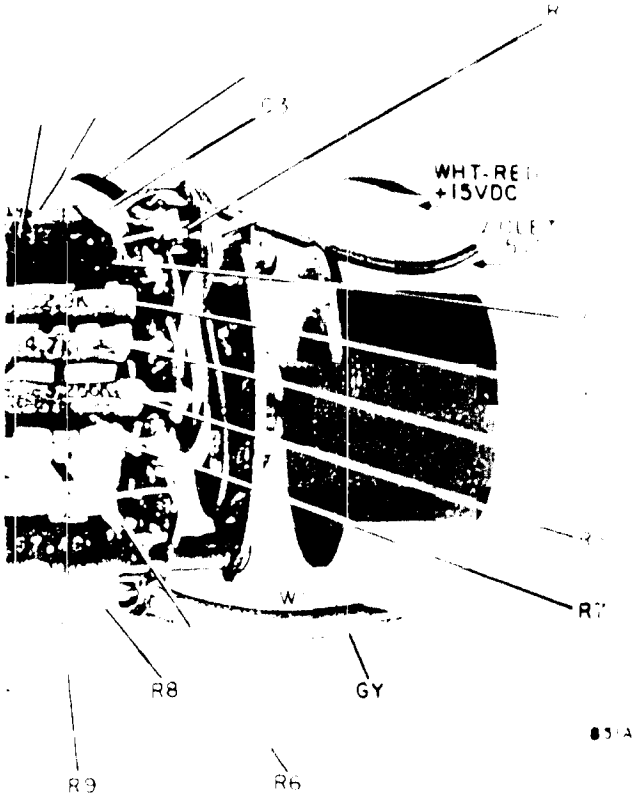
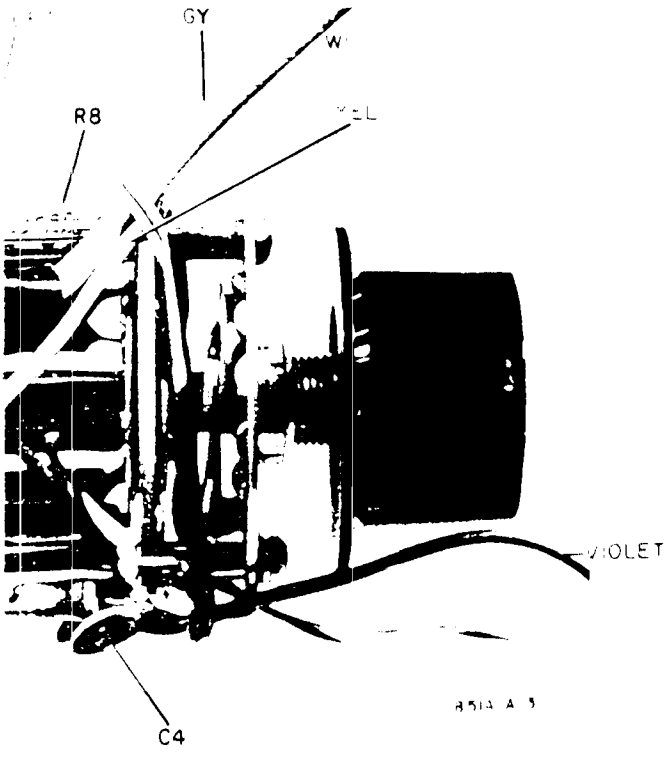


Figure 5-25. VERT DISPLAY Switch A11





ERT DISPLAY Switch A11

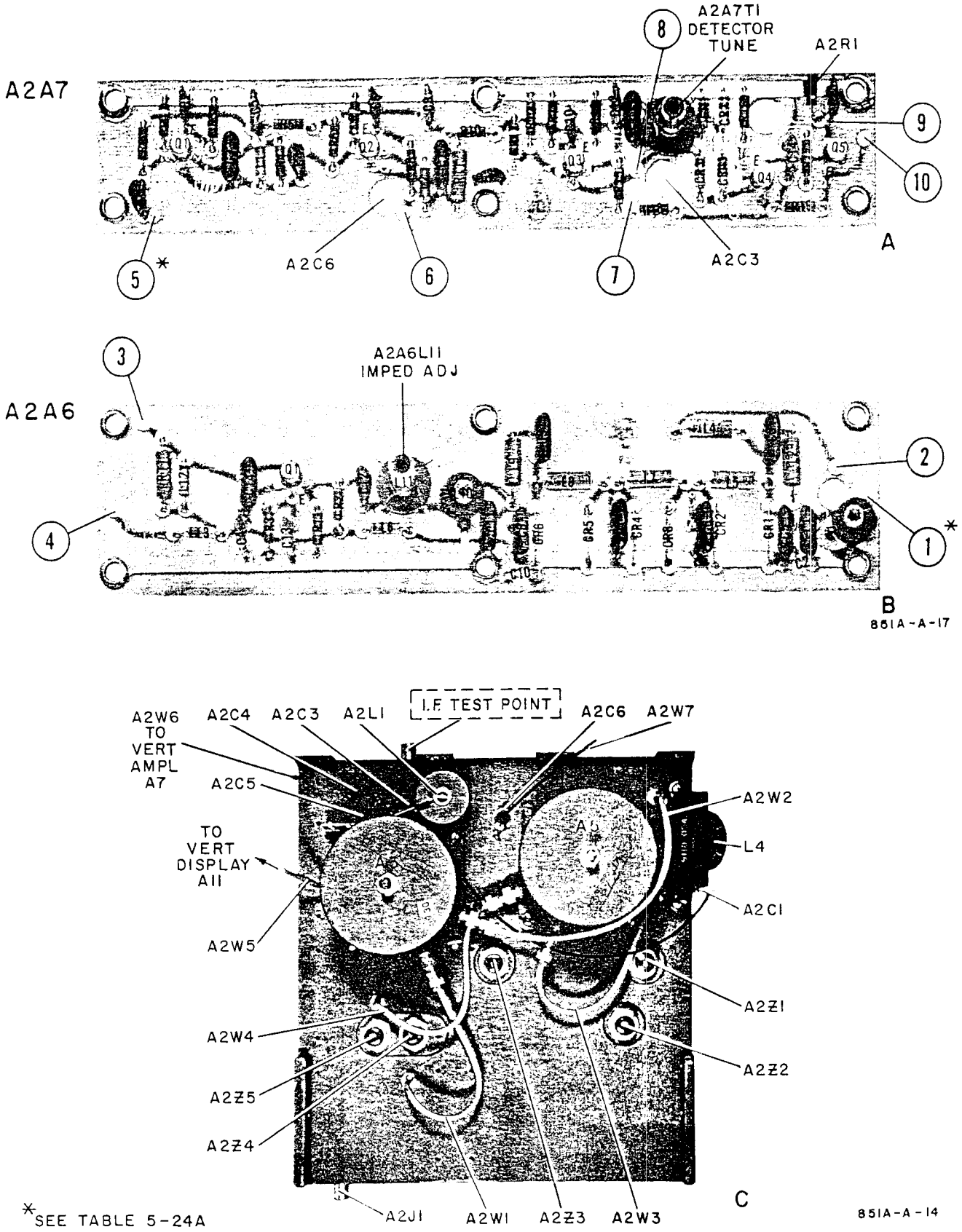
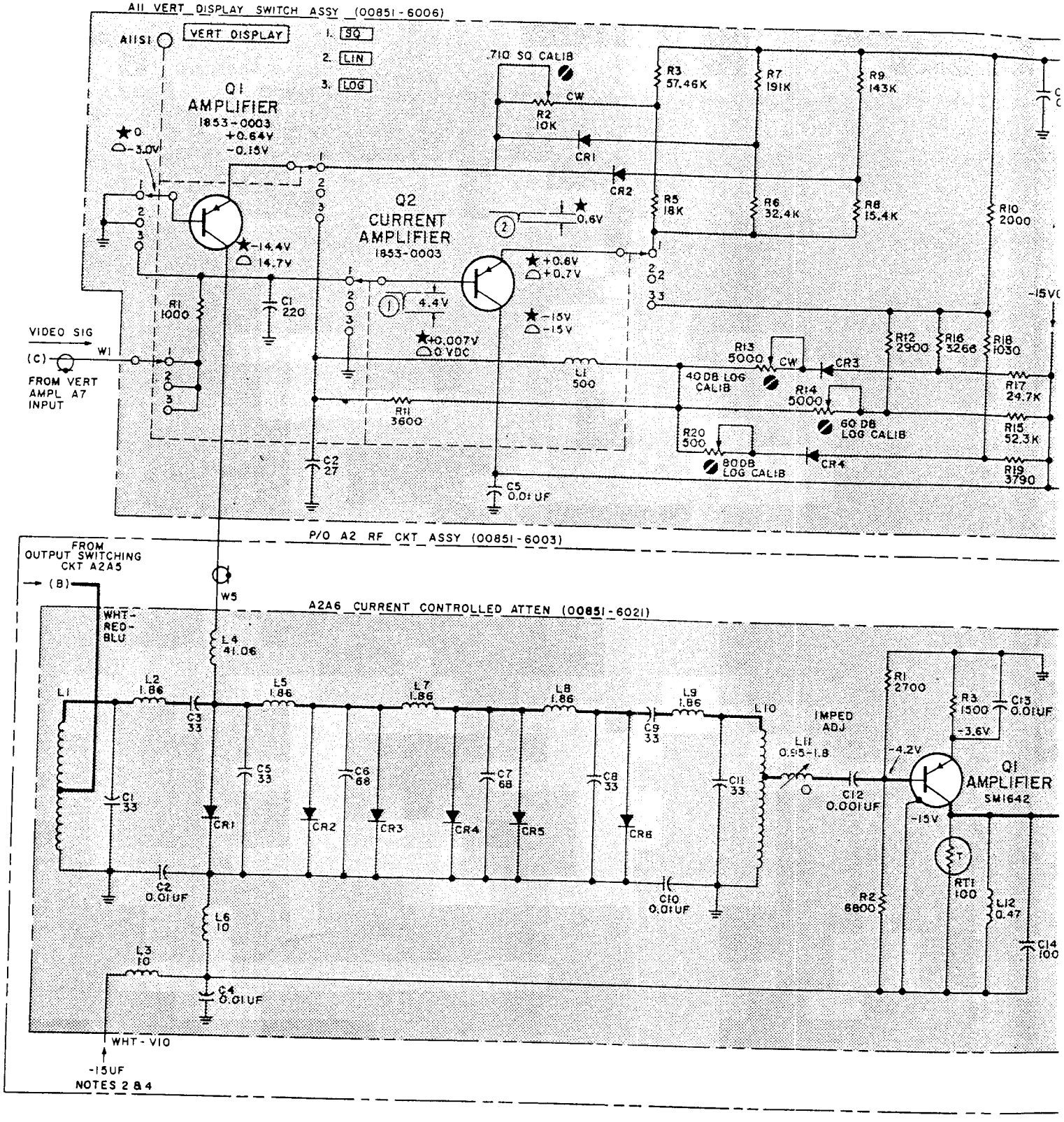
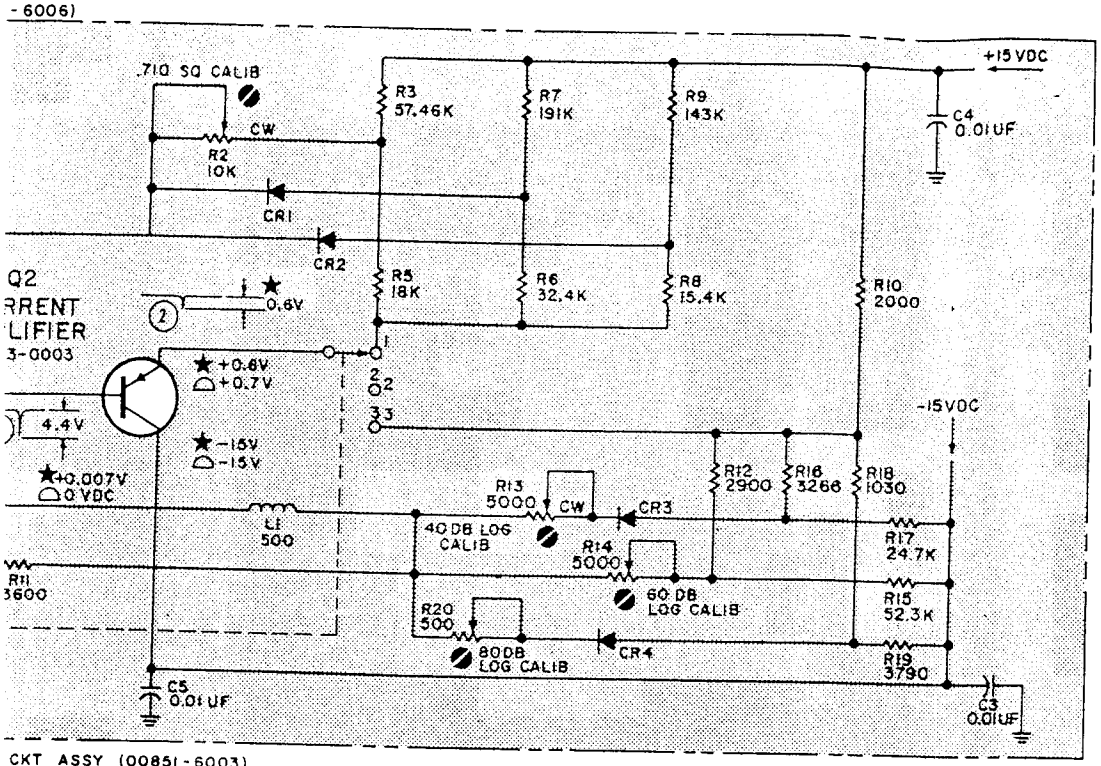


Figure 5-25

Figure 5-26. RF Circuit Assembly Boards A2A6, A2A7, and Rear of Casting


A11 VERT DISPLAY SWITCH ASSY (00851-6006)
A11S1
VERT DISPLAY
1. SQ
2. LIN
3. LOG
Q1 AMPLIFIER 1853-0003 +0.64V -0.15V
Q2 CURRENT AMPLIFIER 1853-0003
.710 SQ CALIB
R2 10K
R3 57.46K
R7 191K
R9 143K
R5 18K
R6 32.4K
R8 15.4K
R10 2000
CR1
CR2
CW
R1 1000
C1 220
C2 27
C5 0.01UF
L1 500
R11 3600
R13 5000
R14 5000
R20 500
40DB LOG CALIB
60 DB LOG CALIB
80DB LOG CALIB
CR3
CR4
R12 2900
R16 3266
R18 1030
R17 24.7K
R15 52.3K
R19 3790
-15VC
VIDEO SIG
(C)
W1
FROM VERT AMPL A7 INPUT
P/O A2 RF CKT ASSY (00851-6003)
FROM OUTPUT SWITCHING CKT A2A5
(B)
W5
WHT-RED-BLU
A2A6 CURRENT CONTROLLED ATTEN (00851-6021)
L1
L2 1.86
L3 10
L4 41.06
L5 1.86
L6 10
L7 1.86
L8 1.86
L9 1.86
L10
L11 0.95-1.8
IMPED ADJ
C1 33
C2 0.01UF
C3 33
C4 0.01UF
C5 33
C6 68
C7 68
C8 33
C9 33
C10 0.01UF
C11 33
C12 0.001UF
CR1
CR2
CR3
CR4
CR5
CR6
R1 2700
R2 6800
R3 1500
Cr3 0.01UF
-3.6V
-4.2V
-15V
Q1 AMPLIFIER SM1642
RT1 100
L12 0.47
C14 100
WHT-VIO
-15UF
NOTES 2 & 4

- 6006)

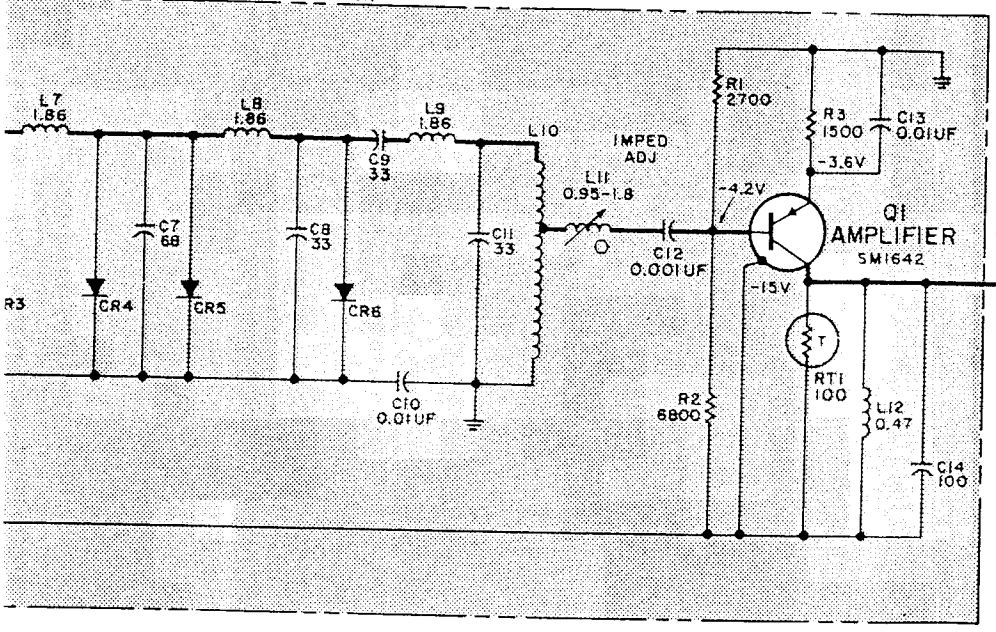


REFERENCE DESIGNATIONS

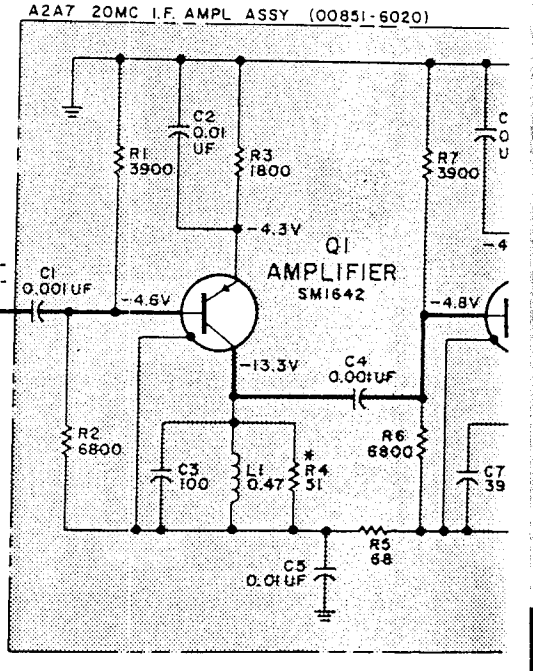
A2	A2
A2A6	C2-4,6
C1-14	C5 } SHOWN ON
CR1-6	L1 } LV PS A9 DIAG
L1-12	
Q1	R1
R1-3	W5,6,7
RT1	A11
A2A7	C1-5
C1-14	CR1-4
CR1-4	L1
L1-2	Q1,2
Q1-5	R1-3,5-20
R1-8,10-19	S1
RT1	W1
T1	
	J5
	R10

UNASSIGNED A2A7R9
A11R4

NT CONTROLLED ATTEN (00851-6021)



A2A7 20MC I.F. AMPL ASSY (00851-6020)



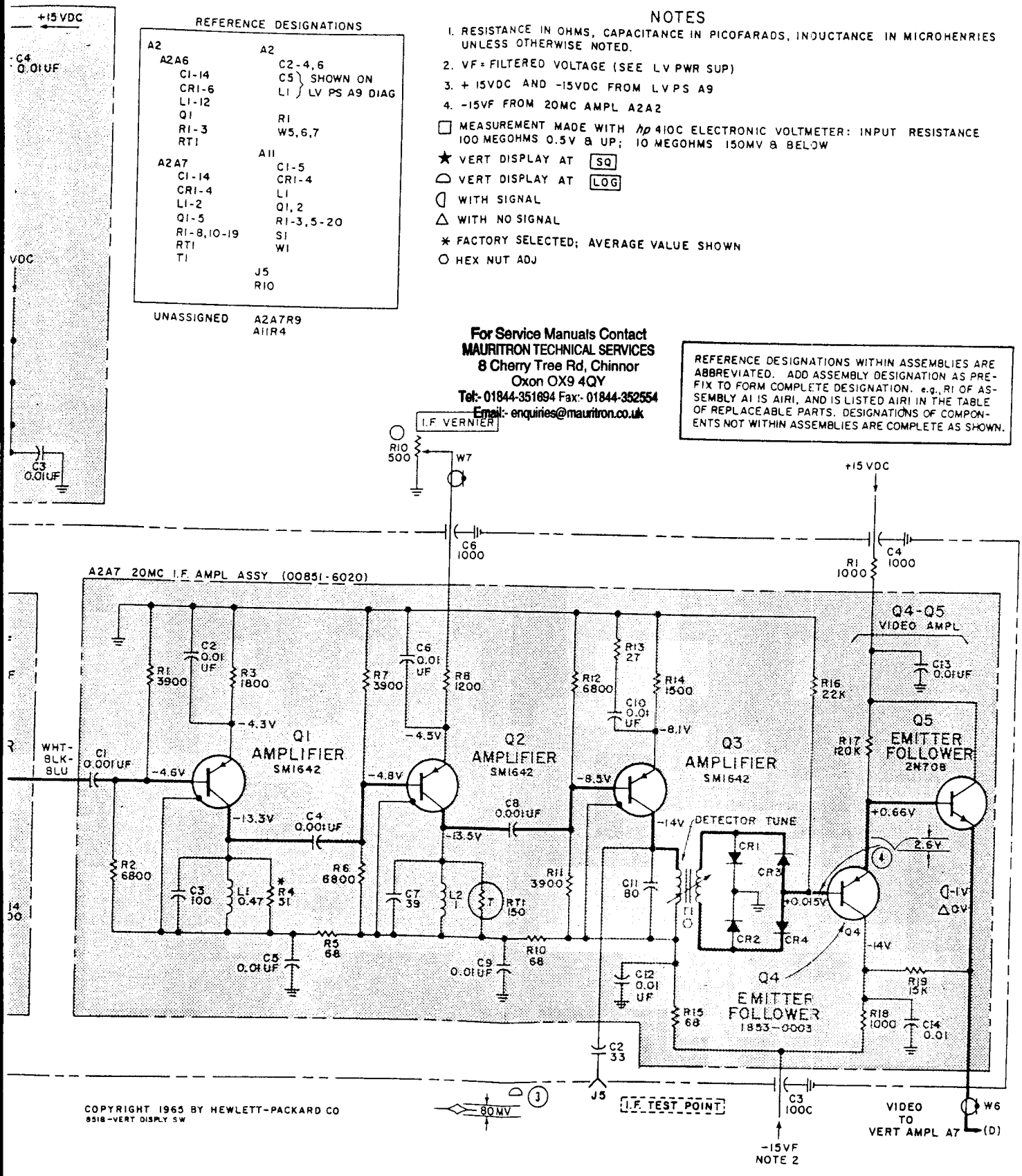


Figure 5-27. VERT DISPLAY Switch, Current-Controlled Attenuator, and 20MC I. F. Amplifier Schematics, 851B

Table 5-26. Connections, Sweep and Horizontal Amplifier Assy A6

Ref No.	Color Code	Connection	Fig. Ref
1	red	+100 vdc input, from LV Power Supply A9	5-37
2	wht	To CRT (V1) horizontal deflection plate, terminal D2	5-33, 5-35
3	grn	To CRT (V1) horizontal deflection plate, terminal D1	5-33, 5-35
4	wht-grn-blu	To R9, HORIZ POS adjust	5-33
5	wht-grn-gra	From adjustable contact on R9, HORIZ POS adjust	5-33
6	wht-grn-vio	To R9, HORIZ POS adjust	5-33
7	blk	Chassis ground	
8	yel	Blanking signal to Vert Amplifier A7	5-29
9	vio	-15 vdc, from LV Power Supply A9	5-37
10	wht-red	+15 vdc, from LV Power Supply A9	5-37
11	wht-red	+15 vdc, from LV Power Supply A9	5-37
12	vio	-15 vdc, from LV Power Supply A9	5-37
13	coax cable W3	To J7, SWEEP OUTPUT, on rear panel	5-33
14	wht-orn-yel	To J8, HORIZ OUTPUT, on rear panel	5-33
15	wht-red-blu	To fixed contact, rear of wafer 2, SWEEP TIME switch, A10S1	5-30, 5-39
16	wht-red-vio	To contactor, front of wafer 1, SWEEP TIME switch, A10S1	5-30, 5-39
17	wht-brn-gra	To contactor, front of wafer 3, SWEEP TIME switch, A10S1	5-30, 5-39
18	wht	To adjustable contact on SWEEP TIME VERNIER, A10R1	5-30, 5-33
19	wht-brn-yel	To fixed contact on front of wafer 3, SWEEP TIME switch, A10S1	5-30, 5-33
20	wht-brn-blu	To fixed contact on front of wafer 3, SWEEP TIME switch, A10S1	5-30, 5-33
21	wht-brn-red	To fixed contact on front of wafer 3, SWEEP TIME switch, A10S1	5-30, 5-33
22	wht-grn	To junction A10R2, VERNIER A10R1	5-33
23	wht-brn-orn	To fixed contact on front of wafer 3, SWEEP TIME switch, A10S1	5-30, 5-33
24	wht-brn-vio	To fixed contact on front of wafer 3, SWEEP TIME switch, A10S1	5-30, 5-33
25	wht-brn-grn	To fixed contact on front of wafer 3, SWEEP TIME switch, A10S1	5-30, 5-33
26	vio	To junction A10R2, VERNIER A10R1	5-33
27	wht-red-grn	To contactor on front of wafer 2, SWEEP TIME switch, A10S1	5-30, 5-33
28	wht	From contactor on rear of wafer 1, SYNC switch S2	5-32
29	vio	-15 vdc, from LV Power Supply A9	5-37
30	blk	Chassis ground	
31	vio	-15 vdc, from LV Power Supply A9	5-37
32	wht-red	+15 vdc, from LV Power Supply A9	5-37
33	wht-grn	To fixed contact on SINGLE SWEEP switch S3	5-33
34	blk	Chassis ground	
35	blk	Chassis ground	
36	coax	To contactor on front of wafer 1, SYNC switch S2	5-33
37	blu	To SINGLE SWEEP lamp DS1	5-33
38	grn	To wafer 1F on SYNC switch S2	5-32
39	grn	To wafer 1F on SYNC switch S2	5-32
40	wht-yel-grn	To wafer 6R on SWEEP TIME switch A10S1	5-30, 5-39
41	wht-red-grn	To SWEEP INPUT J2 on rear panel	5-33
42	wht-orn-grn	To J3, BLANKING INPUT	5-33
43	wht-blu-gra	To wafer 6F on SWEEP TIME switch A10S1	5-30
44	grn	To wafer 6R on SWEEP TIME switch A10S1	5-30
45	wht-yel	To wafer 6R on SWEEP TIME switch A10S1	5-30

Horizontal Amplifier Assy A6

nection	Fig. Ref
Supply A9	5-37
on plate, terminal D2	5-33, 5-35
on plate, terminal D1	5-33, 5-35
	5-33
HORIZ POS adjust	5-33
	5-33
r A7	5-29
A9	5-37
A9	5-37
A9	5-37
A9	5-37
ar panel	5-33
r panel	5-33
2, SWEEP TIME switch, A10S1	5-30, 5-39
SWEEP TIME switch, A10S1	5-30, 5-39
SWEEP TIME switch, A10S1	5-30, 5-39
TIME VERNIER, A10R1	5-30, 5-33
er 3, SWEEP TIME switch, A10S1	5-30, 5-33
er 3, SWEEP TIME switch, A10S1	5-30, 5-33
er 3, SWEEP TIME switch, A10S1	5-30, 5-33
10R1	5-33
er 3, SWEEP TIME switch, A10S1	5-30, 5-33
er 3, SWEEP TIME switch, A10S1	5-30, 5-33
er 3, SWEEP TIME switch, A10S1	5-30, 5-33
10R1	5-33
, SWEEP TIME switch, A10S1	5-30, 5-33
r 1, SYNC switch S2	5-32
A9	5-37
A9	5-37
A9	5-37
EEP switch S3	5-33
, SYNC switch S2	5-33
	5-33
	5-32
	5-32
witch A10S1	5-30, 5-39
anel	5-33
	5-33
witch A10S1	5-30
witch A10S1	5-30
witch A10S1	5-30

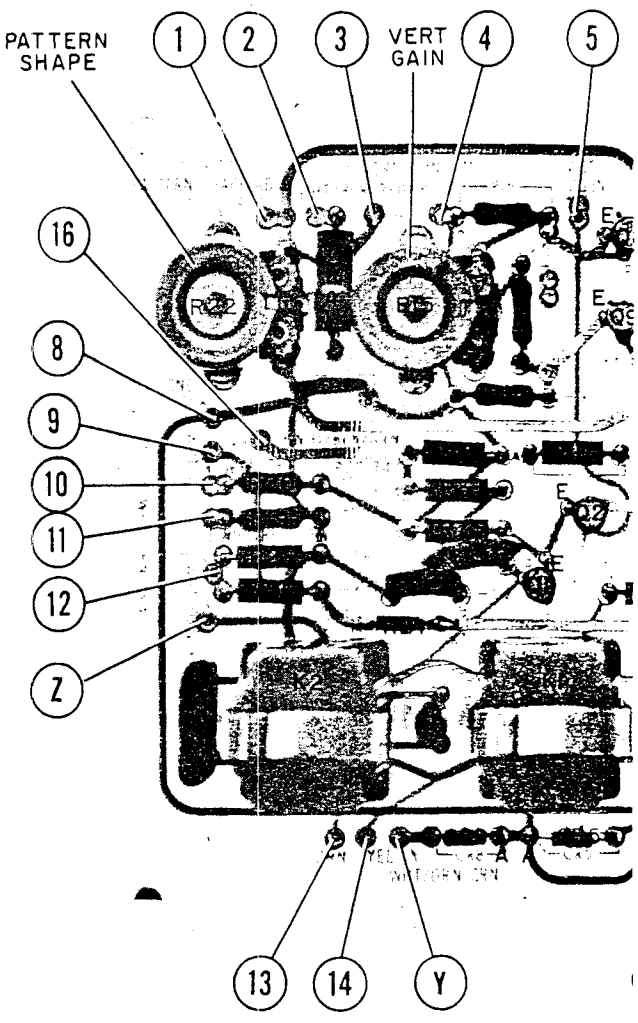


Figure 5-28. Vertic

Table 5-26 Table 5-27. Connections,

Ref No.	Color Code	Connection	Fig. Ref
1	red	+100VDC regulated from LV Pwr Sup A9	5-37
2	wht-blk-red	To Int Level Adj R2	5-35
3	wht	To 3rd Anode, CRT V1	5-35
4	vio	-15VDC reg from LVPS A9	5-37
5	coax	(D) video signal from 20MC I. F. Ampl Assy A2A7	5-27
6	wht	To CRT vert deflection plate D3	5-35
7	grn	To CRT vert deflection plate D4	5-35
8	blk	Chassis ground	5-37
9	wht-red	+15VDC regulated from LV Pwr Sup A9	5-37
10	wht-red-vio	To VERT POS adj R8	5-29
11	wht-red-gra	To VERT POS adj R8	5-29

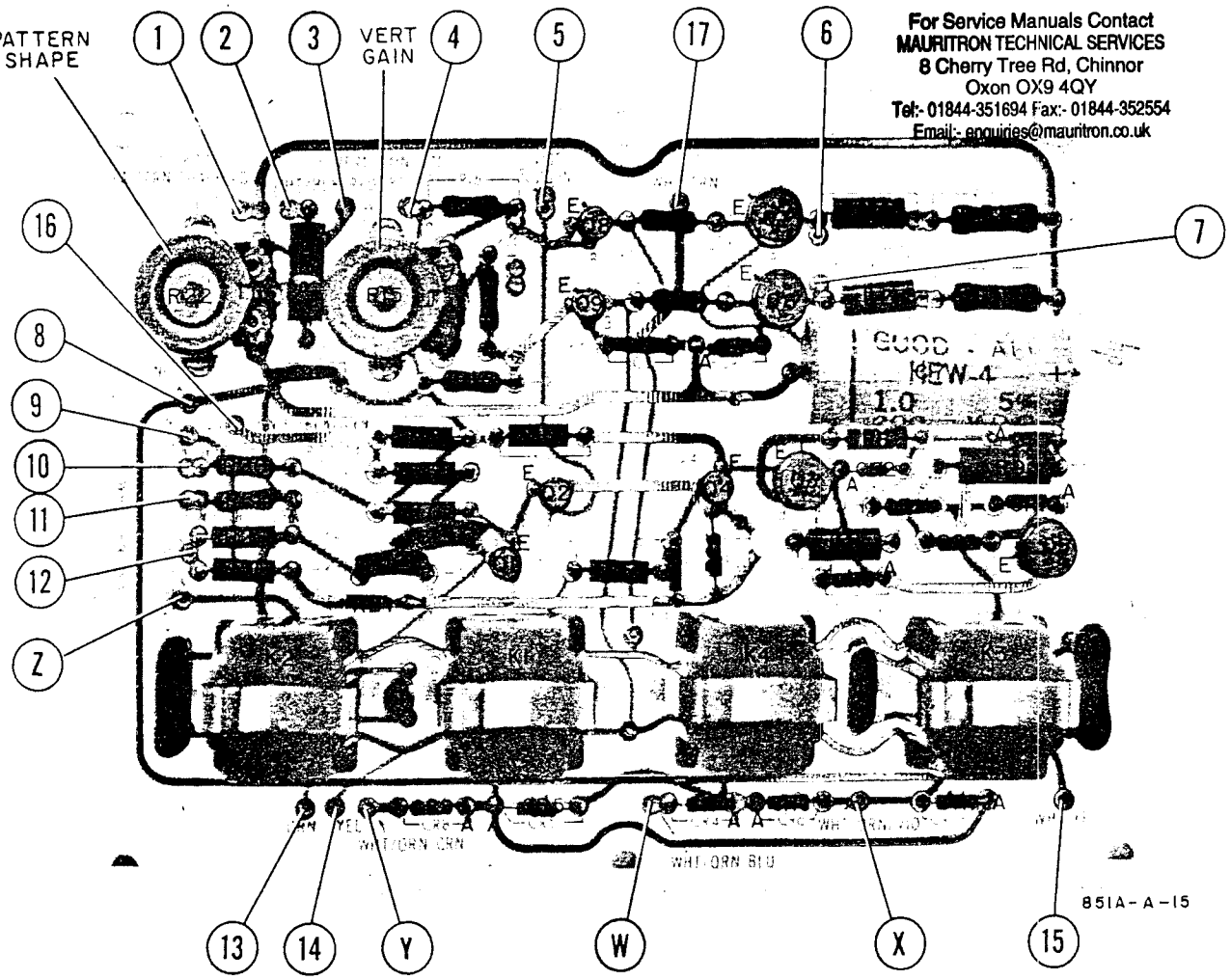


Figure 5-28. Vertical Amplifier A7 Board

Table 5-26

Table 5-27. Connections, Vertical Amplifier A7 Board

Ref No.	Color Code	Connection	Fig. Ref
1	red	+100VDC regulated from LV Pwr Sup A9	5-37
2	wht-blk-red	To Int Level Adj R2	5-35
3	wht	To 3rd Anode, CRT V1	5-35
4	vio	-15VDC reg from LVPS A9	5-37
5	coax	(D) video signal from 20MC I. F. Ampl Assy A2A7	5-27
6	wht	To CRT vert deflection plate D3	5-35
7	grn	To CRT vert deflection plate D4	5-35
8	blk	Chassis ground	5-37
9	wht-red	+15VDC regulated from LV Pwr Sup A9	5-37
10	wht-red-vio	To VERT POS adj R8	5-29
11	wht-red-gra	To VERT POS adj R8	5-29
12	wht-grn-gra	To BASE LINE CLIP. R7	5-29
Z	wht-orn-yel	-24VDC via I. F. BAND-WIDTH switch	5-38
13	grn	From movable contact, BASE LINE CLIP. R7	5-29
14	yel	Blanking signal from Sweep & Horiz Ampl A6 (emitter of A6Q6)	5-33
Y	wht-orn-grn	-24VDC via I. F. BW	5-38
W	wht-orn-blu	-24VDC via I. F. BW	5-38
X	wht-orn-vio	-24VDC via I. F. BW	5-38
15	wht-yel	Blank. sig to HV Pwr Sup A8 (applied to top of INTENSITY divider)	5-35
16	wht-blk-grn	To BASE LINE CLIP. R7	5-29
17	wht-grn	To movable contact VERT POS adjust R8	5-29

NOTES

1. RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS UNLESS OTHERWISE NOTED
2. RELAYS SHOWN DE-ENERGIZED (I.F BANDWIDTH SET AT 10KC)
3. ±15VDC & 100VDC FROM LV PWR SUP A9
4. BASE LINE CLIPPED WITH R7 MAX CW
5. ☐ CONDITIONS OF MEASUREMENT
   a. HP 410C ELECTRONIC VOLTMETER; INPUT RESISTANCE IS 100 MEGOHMS FOR 0.5V & UP, 10 MEGOHMS FOR 150MV & BELOW.
   b. MORE POSITIVE VOLTAGE MEASURED WITH BASE LINE CLIPPER AT MAX CCW
   c. △ = R7 MAX CW
   d. SYNC AT LINE
      I.F BANDWIDTH AT 10KC
6. -24VDC APPLIED VIA I.F BANDWIDTH; SEE FIGURE 5-33
7. CW = MOVABLE CONTACT POSITION WITH ADJUSTMENT TURNED MAX CW
8. SEE TABLE BELOW

REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMBLY DESIGNATION AS PREFIX TO FORM COMPLETE DESIGNATION. e.g., R1 OF ASSEMBLY A1 IS A1R1, AND IS LISTED A1R1 IN THE TABLE OF REPLACEABLE PARTS. DESIGNATIONS OF COMPONENTS NOT WITHIN ASSEMBLIES ARE COMPLETE AS SHOWN.

A7 VERTICAL AMPL ASSY

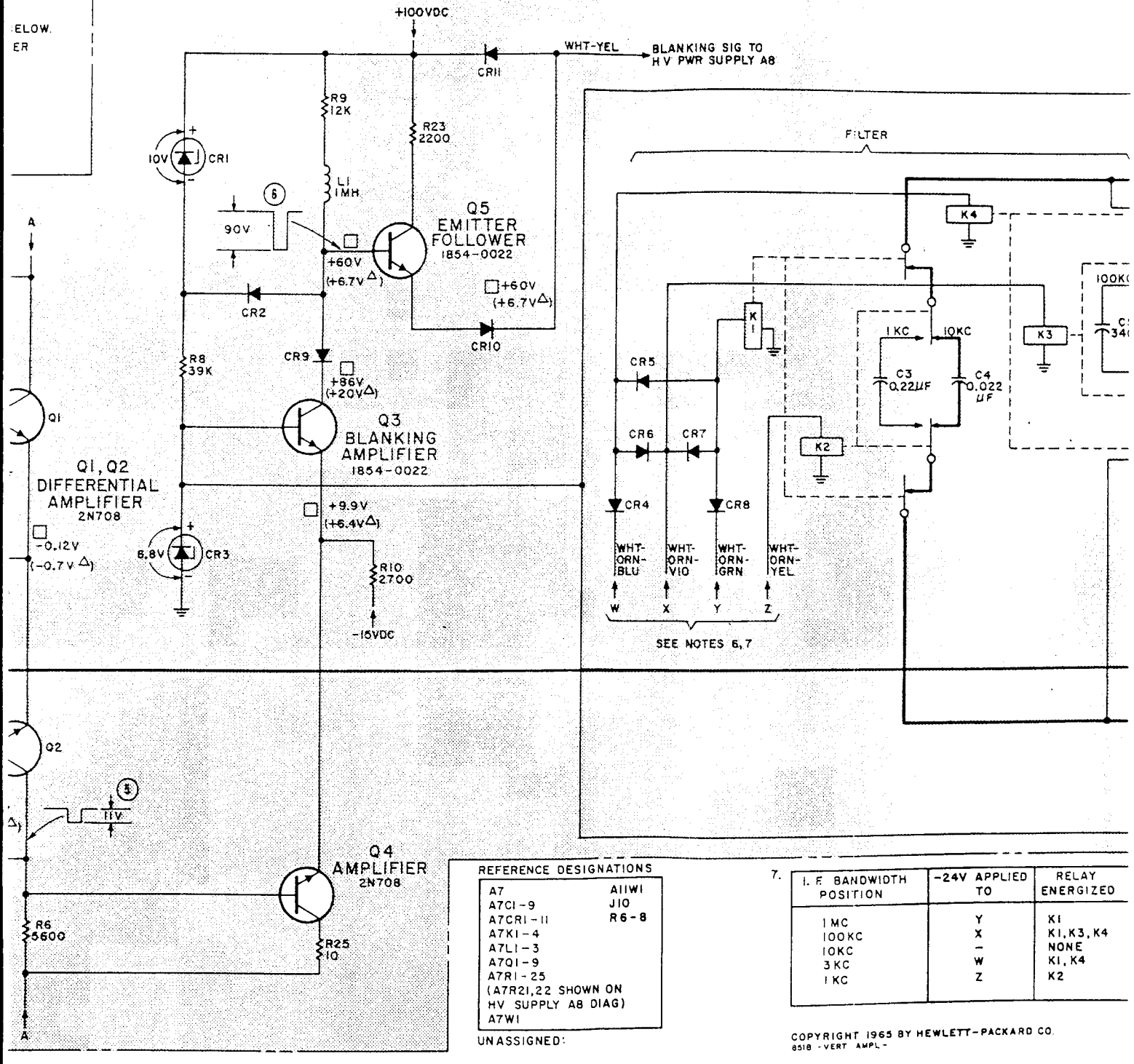
+100VDC
WHT-YEL
CR11
R9 12K
R23 2200
10V CR1
L1 1MH
90V
Q5 EMITTER FOLLOWER 1854-0022
+60V (+6.7V△)
CR2
CR10
R8 39K
CR9
+86V (+20V△)
Q3 BLANKING AMPLIFIER 1854-0022
+9.9V (+6.4V△)
R10 2700
-15VDC
R2 510
R1 6200
A
WHT-GRN-GRA
NOTE 4
BASE LINE CLIPPER
+0.5V (-2V△)
R7 2000
GRN
CW
Q1
C1 0.05μF
WHT-GRN-BLK
J10 VERT OUTPUT
Q1, Q2 DIFFERENTIAL AMPLIFIER 2N708
R6 4700
R3 2000
R4 5600
-0.12V (-0.7V△)
R7 7500
-15VDC
-15VDC
6.8V CR3
VIDEO SIG FROM 20MC I.F AMPL ASSY A2A7
(D)
A11W1
-0.42V (-0.46V△)
Q2
TO VERT DISPLAY
(C)
A11S1
+12.2V (+5.4V△)
5
11V
BLANKING SIG FROM SWEEP & HORIZ AMPL A6
YEL
R5 1800
Q4 AMPLIFIER 2N708
R6 5600
R25 10
R24 100
+15VDC
WHT-RED
A
C2 0.47μF
A

REFERENCE DESIGNA

A7	A
A7C1-9	J
A7CR1-11	R
A7K1-4	
A7L1-3	
A7Q1-9	
A7R1-25	
(A7R21,22 SHOWN O	
HV SUPPLY A8 DIAG	
A7W1	

UNASSIGNED:

REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMBLY DESIGNATION AS PREFIX TO FORM COMPLETE DESIGNATION. e.g., R1 OF ASSEMBLY A1 IS A1R1, AND IS LISTED A1R1 IN THE TABLE OF REPLACEABLE PARTS. DESIGNATIONS OF COMPONENTS NOT WITHIN ASSEMBLIES ARE COMPLETE AS SHOWN.



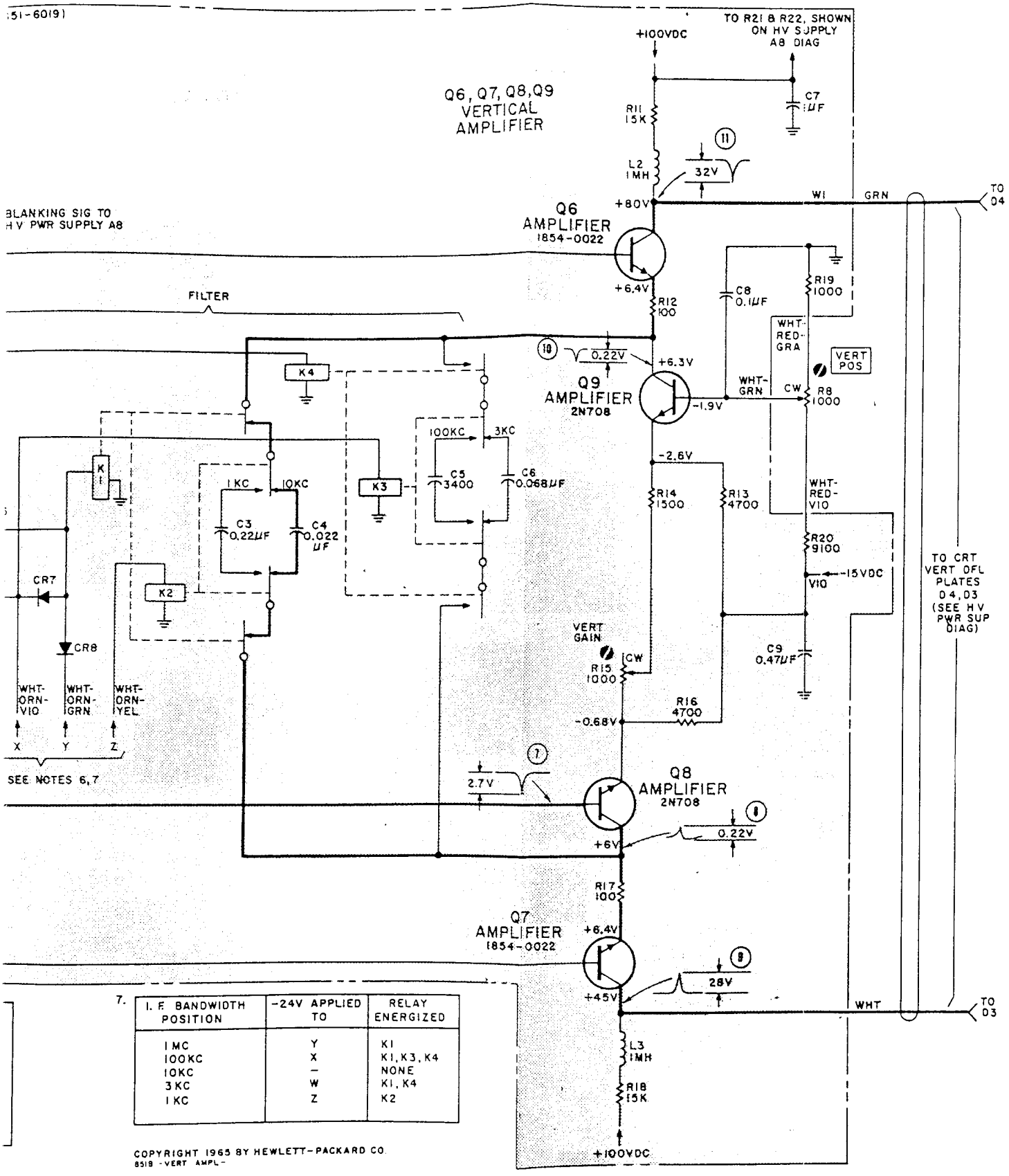
REFERENCE DESIGNATIONS

A7	A1IW1
A7C1-9	J10
A7CR1-11	R6-8
A7K1-4	
A7L1-3	
A7Q1-9	
A7R1-25	
(A7R21,22 SHOWN ON HV SUPPLY A8 DIAG)	
A7W1	

UNASSIGNED:

7.

I. F. BANDWIDTH POSITION	-24V APPLIED TO	RELAY ENERGIZED
1MC	Y	K1
100KC	X	K1, K3, K4
10KC	—	NONE
3KC	W	K1, K4
1KC	Z	K2



7.

I. F. BANDWIDTH POSITION	-24V APPLIED TO	RELAY ENERGIZED
1 MC	Y	K1
100KC	X	K1, K3, K4
10KC	—	NONE
3KC	W	K1, K4
1KC	Z	K2

8518 -VERT AMPL-

Figure 5-29. Vertical Amplifier Schematic, 851B

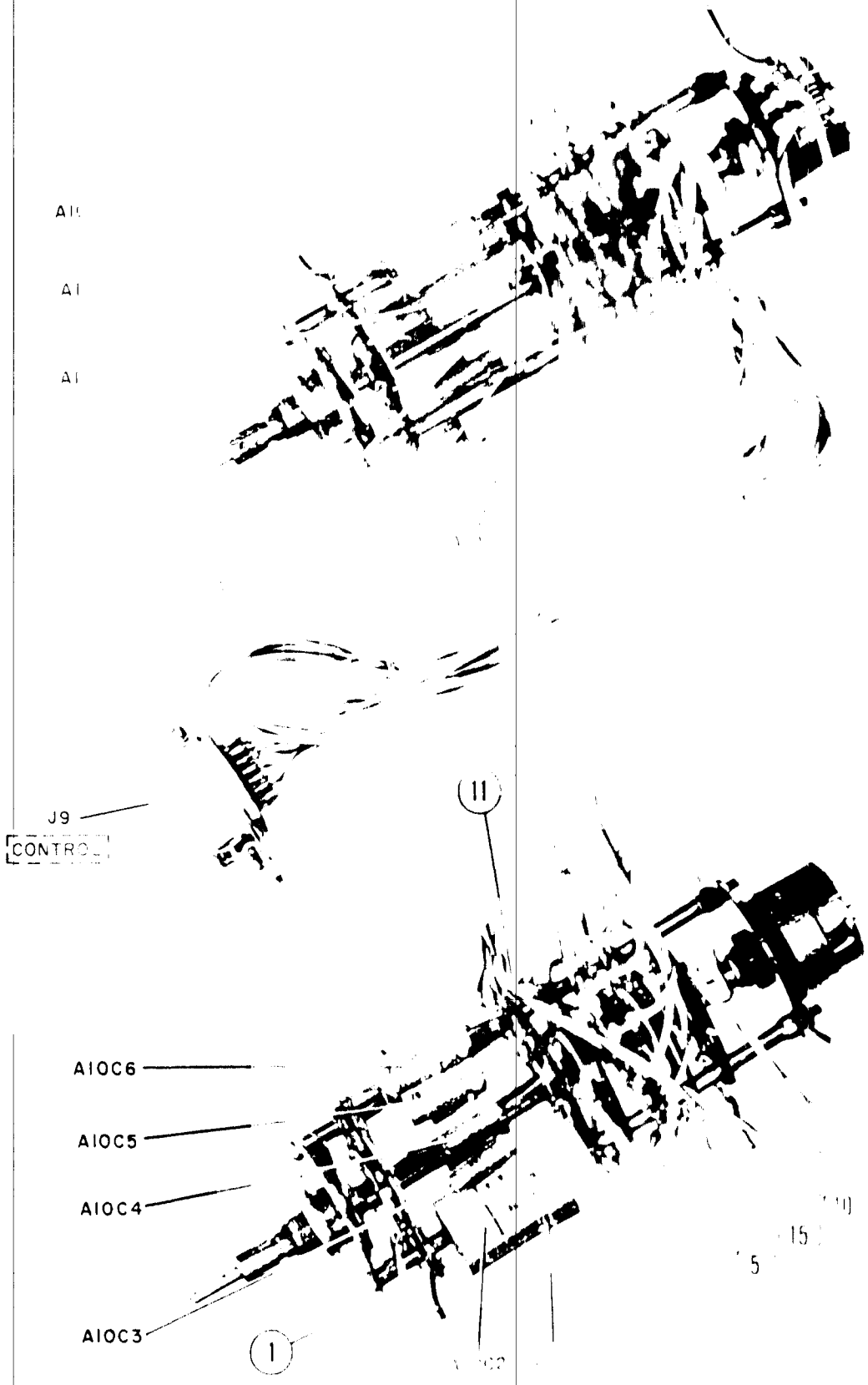
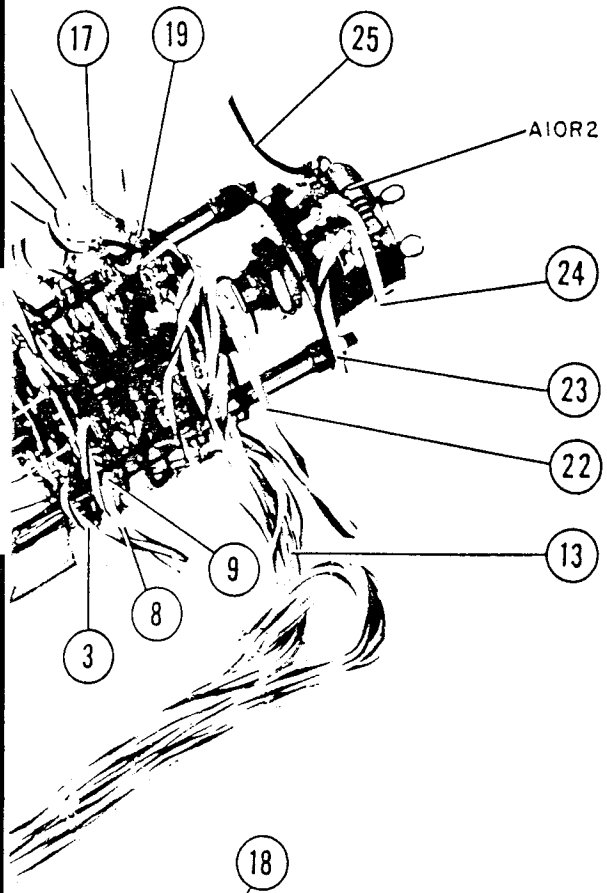
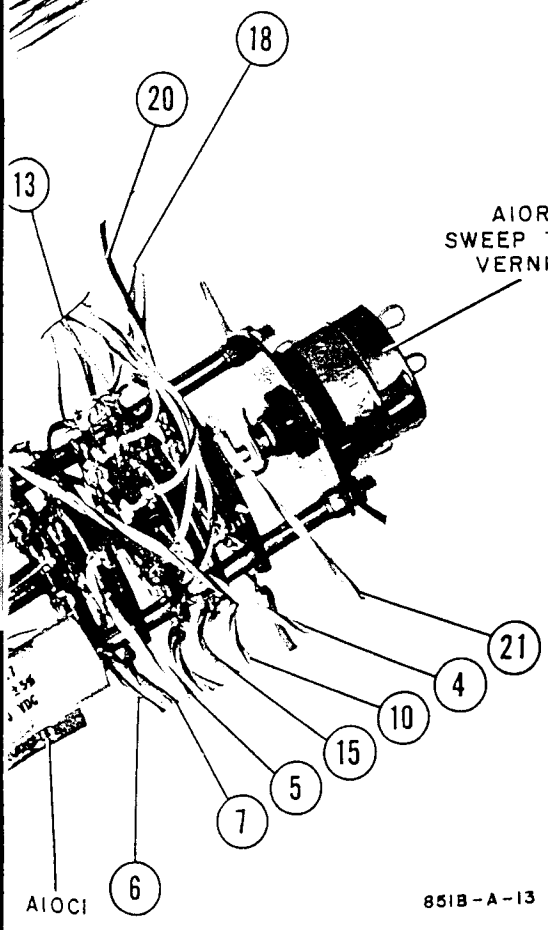


Figure 5-30 SWEEP





Component Identification (see Table 5-28)

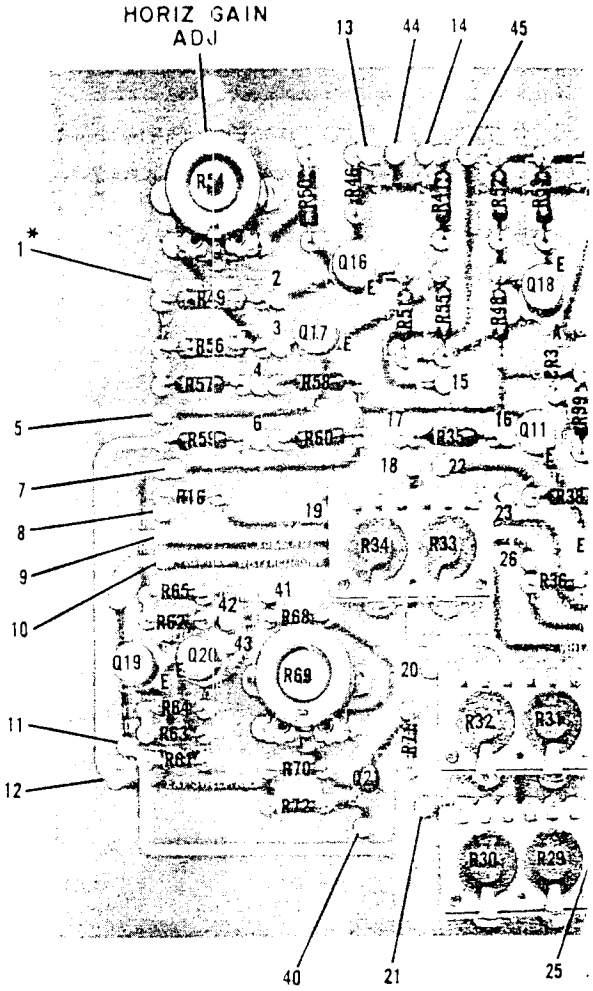


Figure 5-31. Sweep and Horizonta

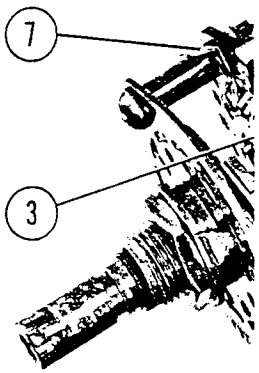


Figure 5-32. SYNC

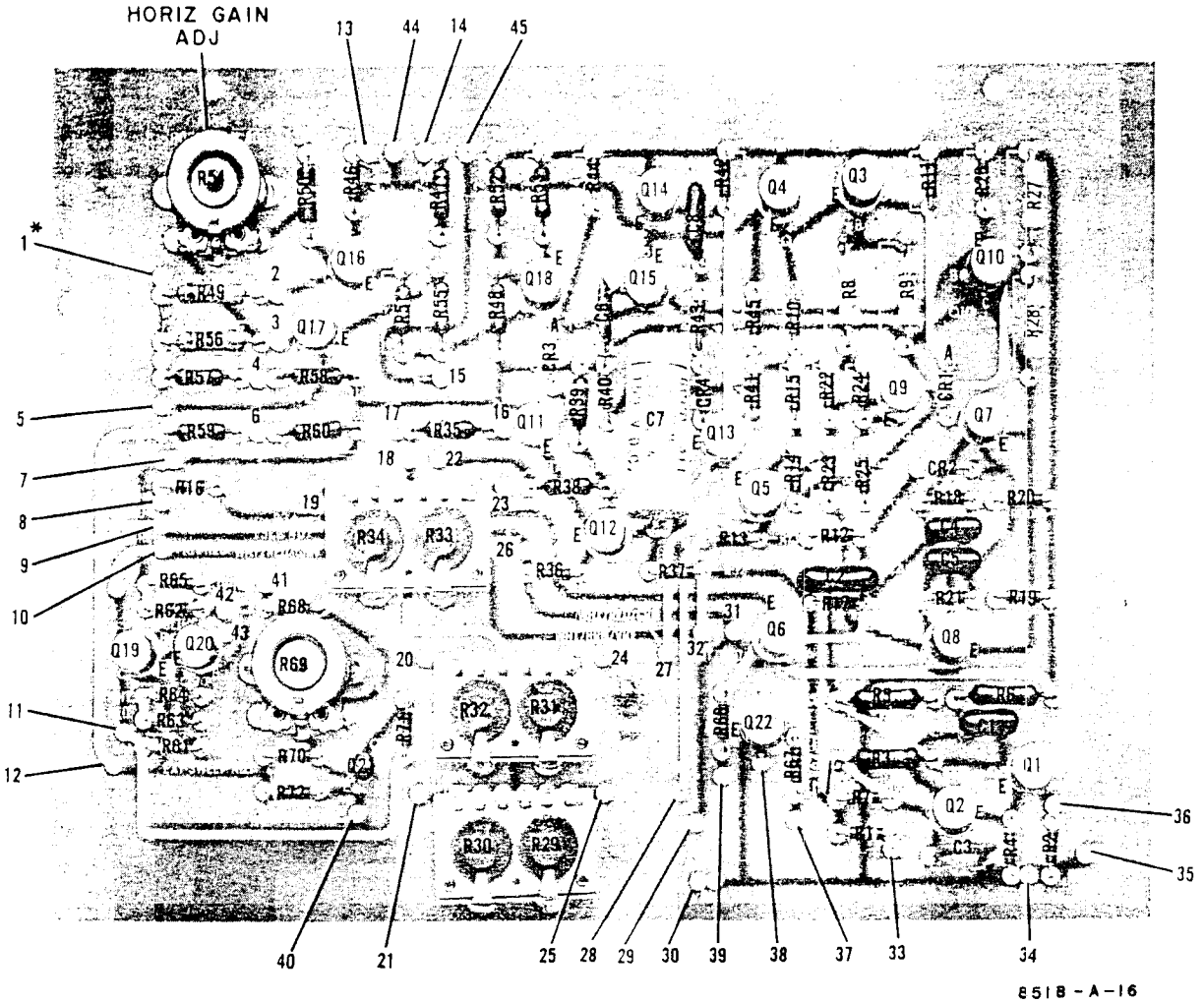


Figure 5-31. Sweep and Horizontal Amplifier A6 Board (see Table 5-26)

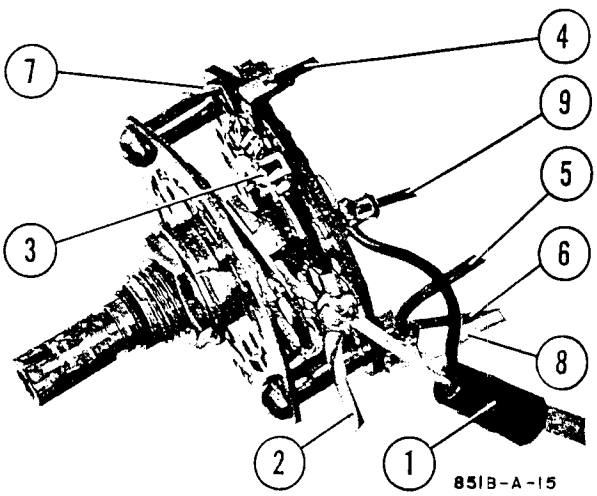
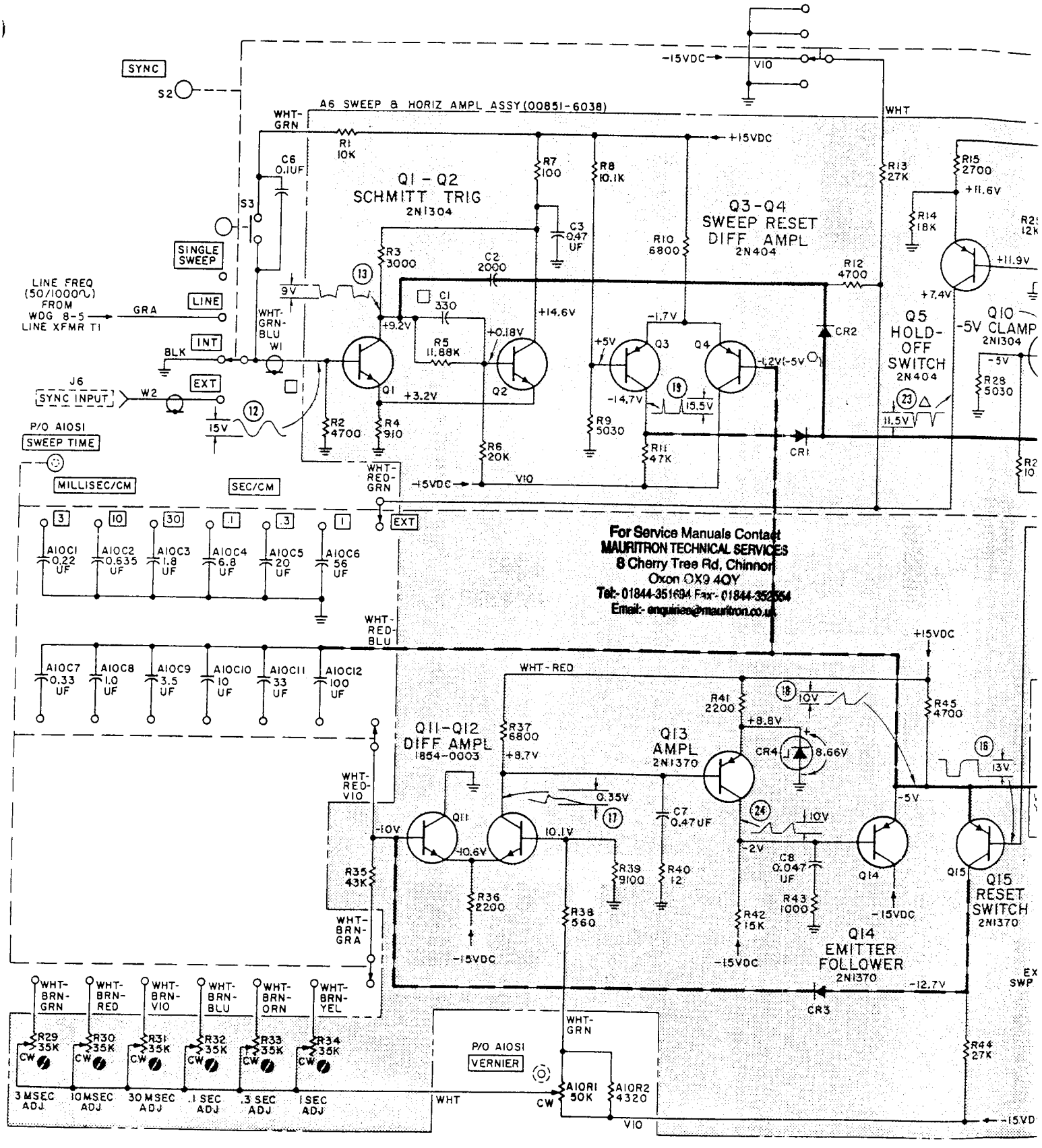
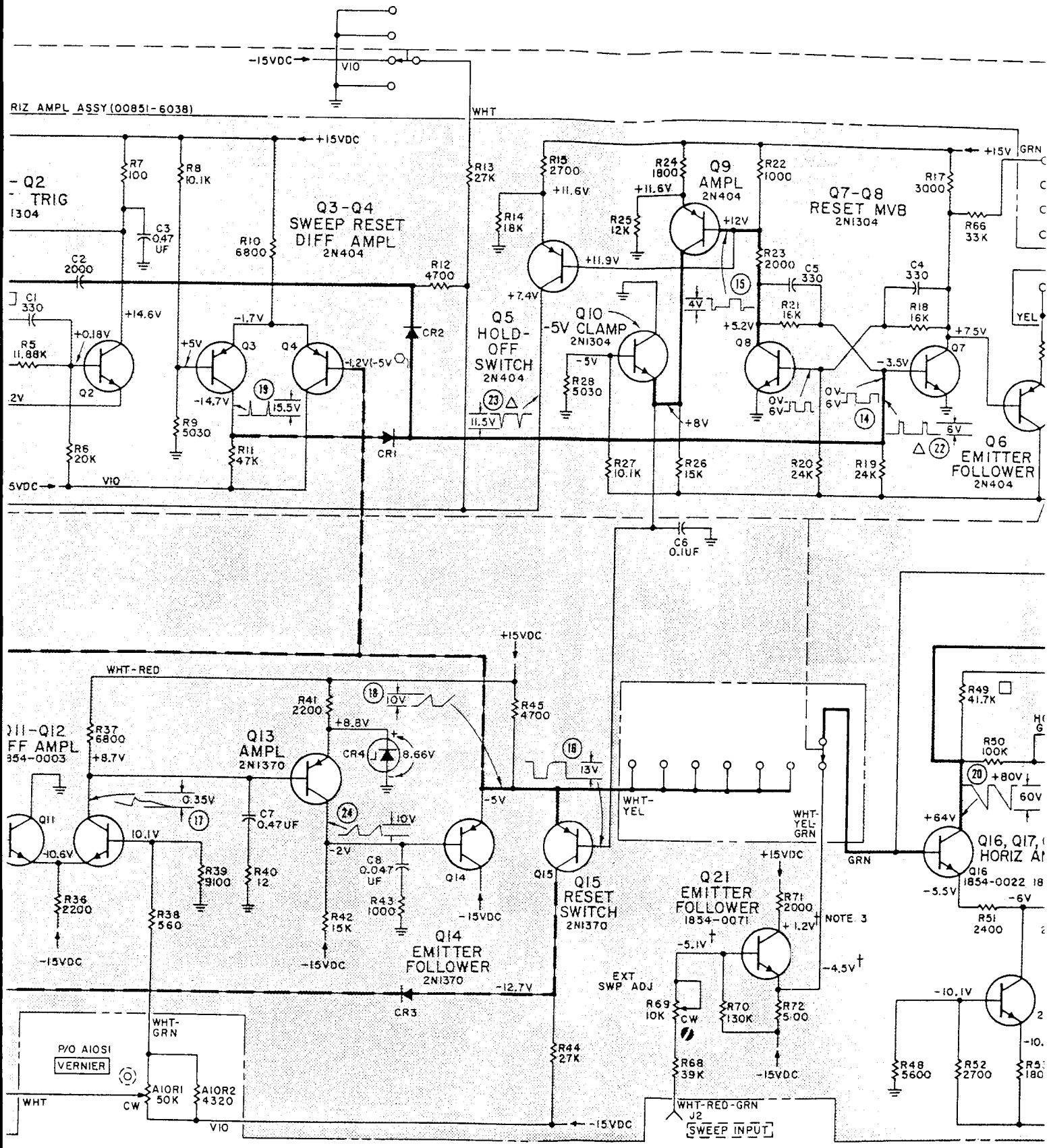
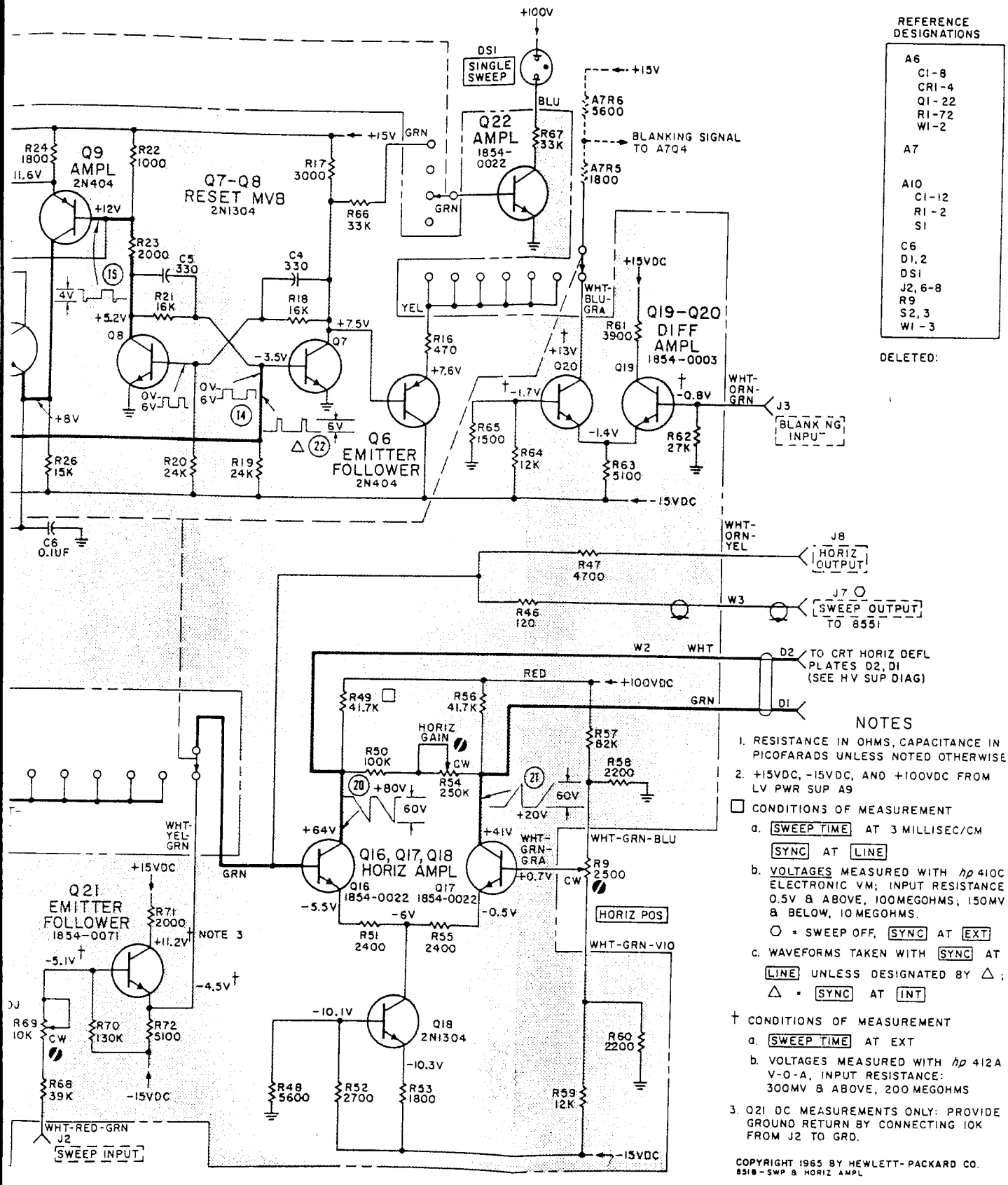


Figure 5-32. SYNC Switch S2 (see Table 5-30)




-15VDC
V10
RIZ AMPL ASSY (00851-6038)
WHT
+15VDC
Q2 TRIG 1304
R7 100
R8 10.1K
C3 0.47 UF
C2 2000
C1 330
+14.6V
+0.18V
R5 11.88K
Q2
2V
R6 20K
5VDC
V10
Q3-Q4 SWEEP RESET DIFF AMPL 2N404
R10 6800
R12 4700
-1.7V
+5V
Q3
Q4
-1.2V(-5V)
-14.7V
18
15.5V
R9 5030
R11 47K
CR1
CR2
R13 27K
Q5 HOLD-OFF SWITCH 2N404
23
11.5V
R15 2700
+11.6V
R14 18K
+7.4V
R24 1800
+11.6V
Q9 AMPL 2N404
R25 12K
+11.9V
+12V
R22 1000
R23 2000
C5 330
15
4V
+5.2V
Q8
Q10 -5V CLAMP 2N1304
-5V
R28 5030
+8V
0V 6V
Q7-Q8 RESET MVB 2N1304
R17 3000
+15V
GRN
R66 33K
C4 330
R18 16K
R21 16K
+7.5V
Q7
-3.5V
YEL
14
6V
22
Q6 EMITTER FOLLOWER 2N404
R27 10.1K
R26 15K
R20 24K
R19 24K
C6 0.1UF
+15VDC
WHT-RED
Q11-Q12 FF AMPL 354-0003
R37 6800
+8.7V
Q11
-10.6V
10.1V
R36 2200
-15VDC
R38 560
R39 9100
R40 12
0.35V
17
C7 0.47UF
R41 2200
+8.8V
Q13 AMPL 2N1370
CR4
8.66V
18
10V
24
10V
-2V
C8 0.047 UF
R42 15K
R43 1000
-15VDC
Q14
Q14 EMITTER FOLLOWER 2N1370
-12.7V
CR3
R45 4700
16
13V
-5V
Q15
Q15 RESET SWITCH 2N1370
WHT-YEL
WHT-YEL-GRN
GRN
+15VDC
Q21 EMITTER FOLLOWER 1854-0071
R71 2000
+1.2V
NOTE 3
-5.1V
-4.5V
EXT SWP ADJ
R69 10K
CW
R70 130K
R72 500
R68 39K
-15VDC
R44 27K
-15VDC
WHT-RED-GRN
J2
SWEEP INPUT
R49 41.7K
R50 100K
20
+80V
60V
+64V
Q16, Q17, HORIZ AM
Q16 1854-0022
-5.5V
-6V
R51 2400
-10.1V
R48 5600
R52 2700
P/O A10S1
VERNIER
WHT
WHT-GRN
CW
A10R1 50K
A10R2 4320
V10



REFERENCE DESIGNATIONS

A6
C1-8
CR1-4
Q1-22
R1-72
W1-2

A7

A10
C1-12
R1-2
S1

C6
D1, 2
DS1
J2, 6-8
R9
S2, 3
W1-3

DELETED:

NOTES

1. RESISTANCE IN OHMS, CAPACITANCE IN PICOFARADS UNLESS NOTED OTHERWISE
2. +15VDC, -15VDC, AND +100VDC FROM LV PWR SUP A9

□ CONDITIONS OF MEASUREMENT
   a. SWEEP TIME AT 3 MILLISEC/CM
      SYNC AT LINE
   b. VOLTAGES MEASURED WITH *hp* 410C ELECTRONIC VM; INPUT RESISTANCE: 0.5V & ABOVE, 100MEGOHMS; 150MV & BELOW, 10 MEGOHMS.
      ○ = SWEEP OFF, SYNC AT EXT
   c. WAVEFORMS TAKEN WITH SYNC AT LINE UNLESS DESIGNATED BY △;
      △ = SYNC AT INT

† CONDITIONS OF MEASUREMENT
   a. SWEEP TIME AT EXT
   b. VOLTAGES MEASURED WITH *hp* 412A V-O-A, INPUT RESISTANCE: 300MV & ABOVE, 200 MEGOHMS

3. Q21 DC MEASUREMENTS ONLY: PROVIDE GROUND RETURN BY CONNECTING 10K FROM J2 TO GRD.

Figure 5-33. Sweep and Horizontal Amplifier Schematic, 851B

Table 5-28. Connections, SWEEP TIME Switch A10S1, 851B

Ref No.	Color Code	Wafer	Connections	Fig. Ref
1	wht-red-vio	1F	Contactor; connects to Sweep Capacitors A10C7-A10C12 From junction of A6R35, base of A6Q11, p/o Miller Integrator in Sweep Generator	5-33
2	blk	1R	Ground for Reset Capacitors A10C1-A10C6; strap	
3	wht-red-grn	2F	Contactor; connects to Reset Capacitors A10C1-A10C6 From A6R13: when SYNC is at INT, -15VDC comes in over this lead.	5-33
4	wht-red-blu	2R	Ramp voltage from Miller Integrator A6Q11-A6Q14. To tie point for Sweep Capacitors A10C7-A10C12	5-33
5	wht-brn-gra	3F	Contactor; connects to leads outgoing to Sweep Time Adjusts From A6R35	5-33
6	wht-brn-yel		To A6R34, 1 Sec Adj	5-33
7	wht-brn-orn		To A6R33, .3 Sec Adj	5-33
8	wht-brn-blu		To A6R32, .1 Sec Adj	5-33
9	wht-brn-vio		To A6R31, 30 Msec Adj	5-33
10	wht-brn-red		To A6R30, 10 Msec Adj	5-33
11	wht-brn-grn		To A6R29, 3 Msec Adj	5-33
12	wht-blk-yel	4F	Contactor; to I. F. BANDWIDTH, wafer 1R	5-38
13	wht-brn wht-red wht-orn wht-grn		To pins on CONTROL connector J9 pin 1 pin 2 pin 3 pin 4	5-39
14	wht-blk-blu	4R	Contactor; to I. F. BANDWIDTH, wafer 1F To pins on CONTROL connector J9	5-38 5-39
	wht-blu wht-vio		pin 5 pin 6	
15	wht-blk-vio	5F	Contactor; to I. F. BANDWIDTH, wafer 2R To pins on CONTROL connector J9	5-38 5-39
	wht-gra wht wht-blk		pin 8 pin 9 pin 10 } by strap, from 5R	
16	wht-blk-grn	5R	Contactor; to I. F. BANDWIDTH, wafer 2F To pins on CONTROL connector J9	5-38 5-39
	wht-gra wht wht-blk		pin 8 pin 9 pin 10	
17	yel	6F	From A6Q6 emitter (blanking signal)	5-33
18	wht-blu-gra		From A6Q20 collector (amplified external blanking signal)	
19	yel		Contactor; to Blanking Amplifier A7Q4-A7Q3	
20	grn	6R	Contactor; to base of A6Q16, Horizontal Amplifier	
21	wht-yel-grn		From emitter of A6Q21 in external sweep input circuit	
22	wht-yel		From emitter of A6Q14, Sweep Generator output	
23	wht-grn		From SWEEP TIME VERNIER A10R1, via A6R38, to base of A6Q12 in Sweep Generator Miller Integrator	
24	wht		From Sweep Time Adjusts A6R29-A6R34 to adjustable contact on SWEEP TIME VERNIER A10R1	
25	vio		Returns A10R1 to -15VDC	

'EEP TIME Switch A10S1, 851B

Connections	Fig. Ref
nects to Sweep Capacitors A10C7-A10C12 of A6R35, base of A6Q11, p/o Miller Sweep Generator	5-33
set Capacitors A10C1-A10C6; strap	
nects to Reset Capacitors A10C1-A10C6 when SYNC is at INT, -15VDC comes in d.	5-33
from Miller Integrator A6Q11-A6Q14. r Sweep Capacitors A10C7-A10C12	5-33
nects to leads outgoing to Sweep Time Adjusts	5-33
ec Adj	5-33
Sec Adj	5-33
Sec Adj	5-33
Msec Adj	5-33
Msec Adj	5-33
Isec Adj	5-33
. F. BANDWIDTH, wafer 1R	5-38
NTROL connector J9	5-39
. F. BANDWIDTH, wafer 1F	5-38
NTROL connector J9	5-39
. F. BANDWIDTH, wafer 2R	5-38
NTROL connector J9	5-39
strap, from 5R	
. F. BANDWIDTH, wafer 2F	5-38
NTROL connector J9	5-39
itter (blanking signal)	5-33
ollector (amplified external blanking signal)	
Blanking Amplifier A7Q4-A7Q3	
ase of A6Q16, Horizontal Amplifier	
of A6Q21 in external sweep input circuit	
of A6Q14, Sweep Generator output	
TIME VERNIER A10R1, via A6R38, to base weep Generator Miller Integrator	
me Adjusts A6R29-A6R34 to adjustable EEP TIME VERNIER A10R1	
to -15VDC	

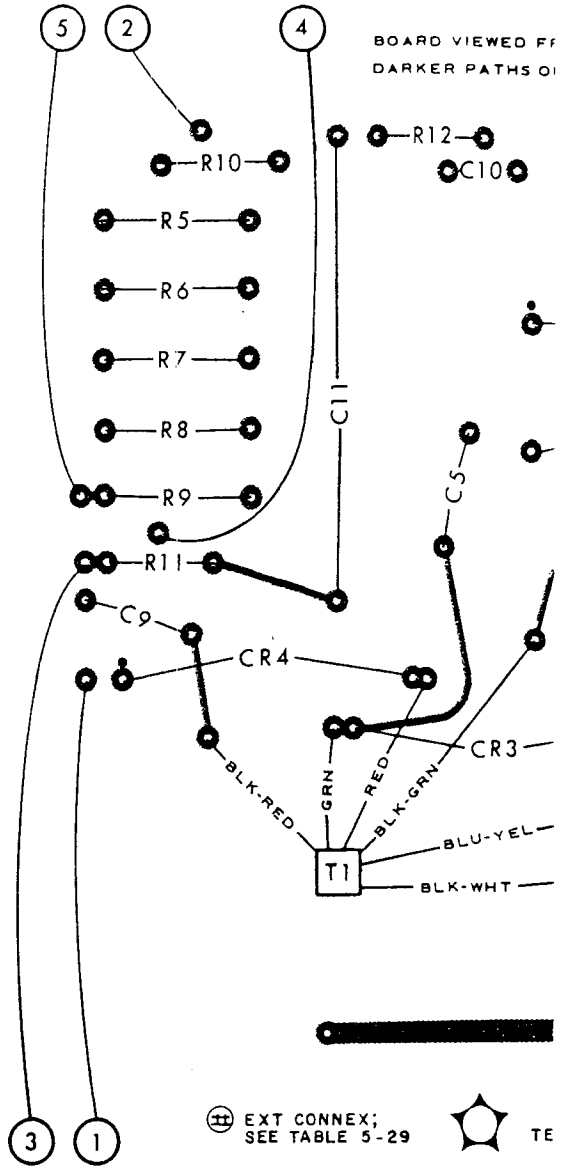


Figure 5-34.

Table 5-28

Table 5-29. Conne

Ref* No.	Color Code	Connection
1	yel	To terminal on INTENSITY control R1
2	wht-yel	From Vert Ampl A7 (blankir signal)
3	wht	From adjustable contact on INTENSITY control R1
4	grn	To grid, pin 3, CRT (V1)
5	red	To terminal on INTENSITY control R1
6	gra	To cathode, pin 2, CRT (V1)

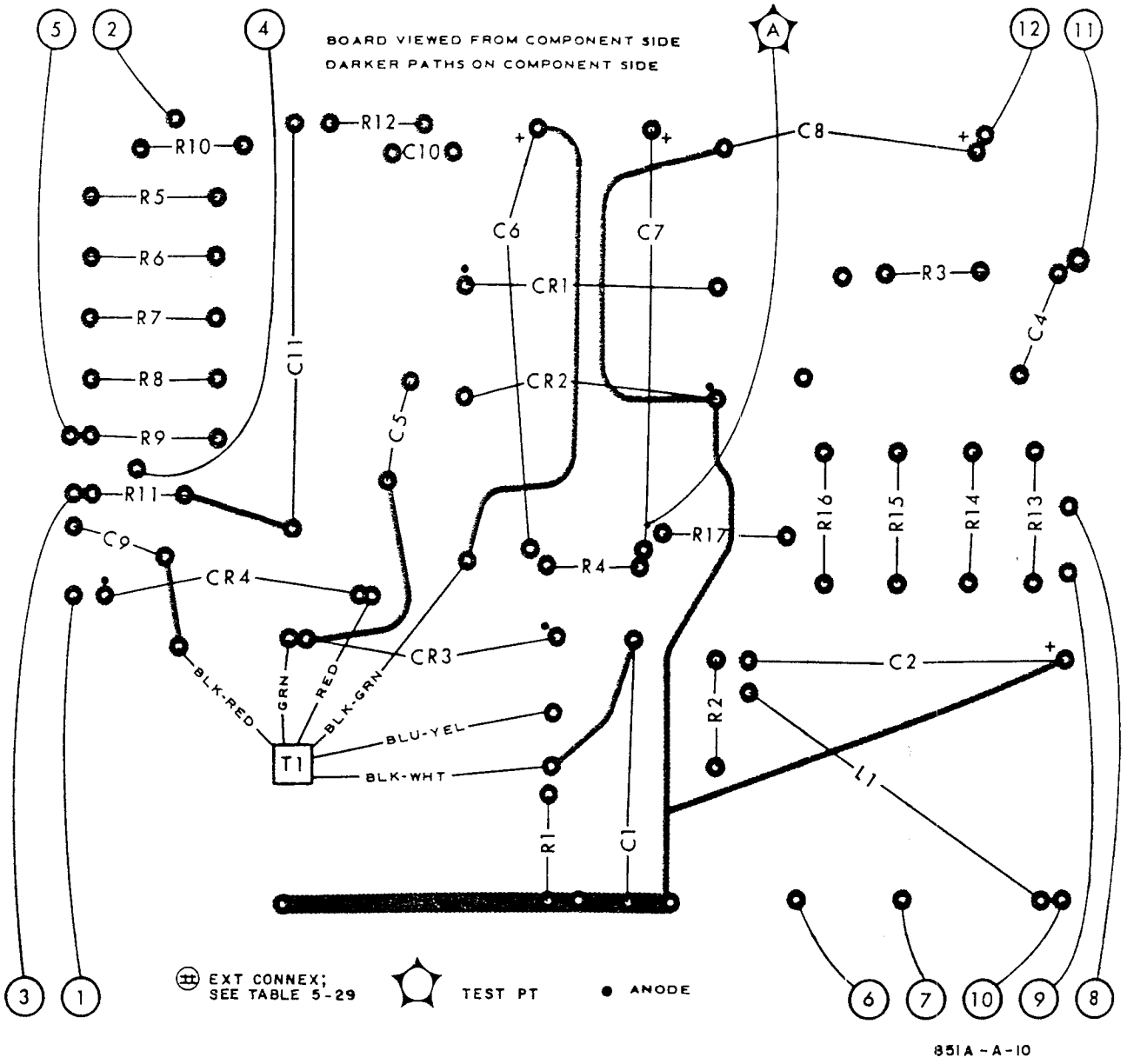


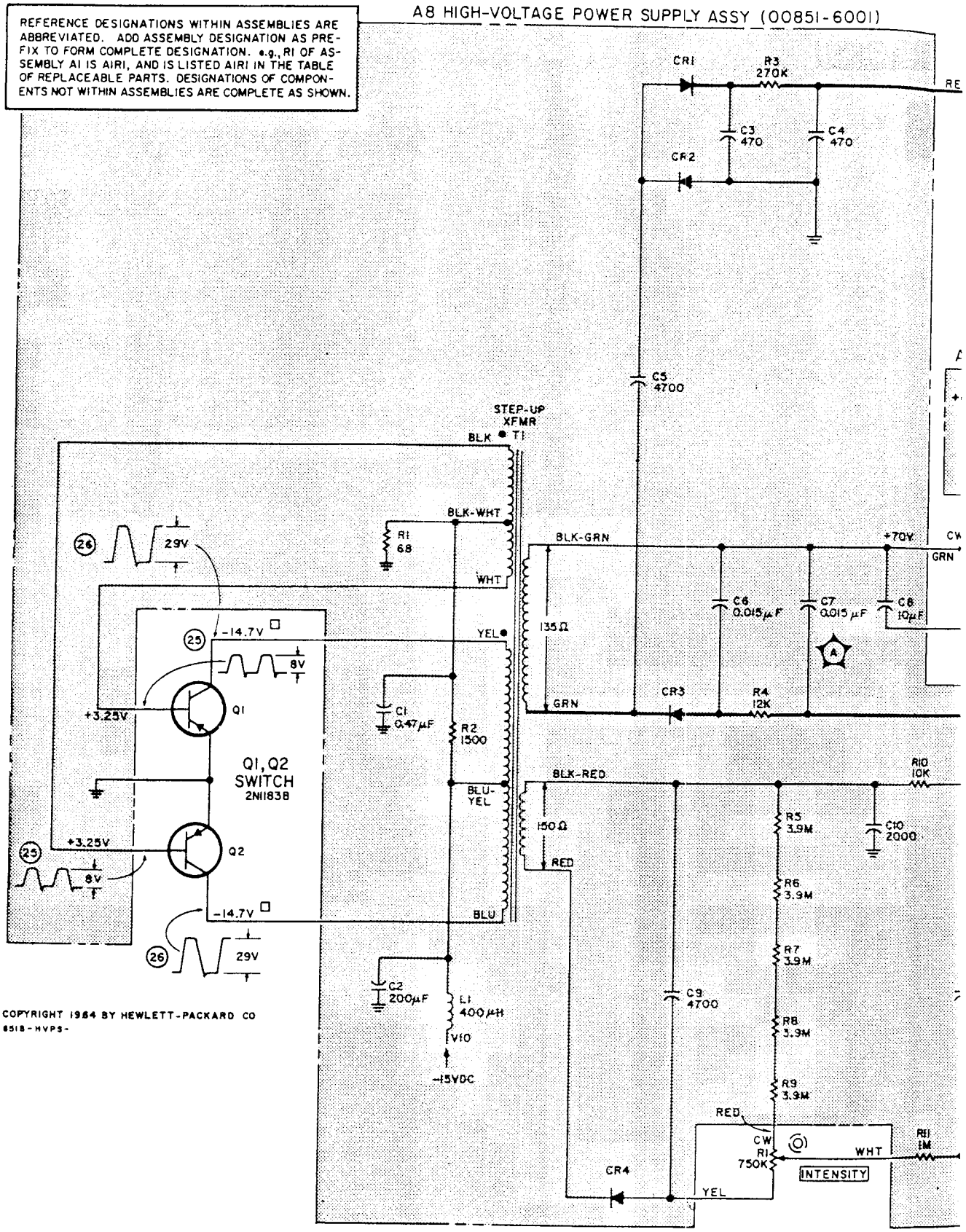
Figure 5-34. HV Power Supply A8 Board

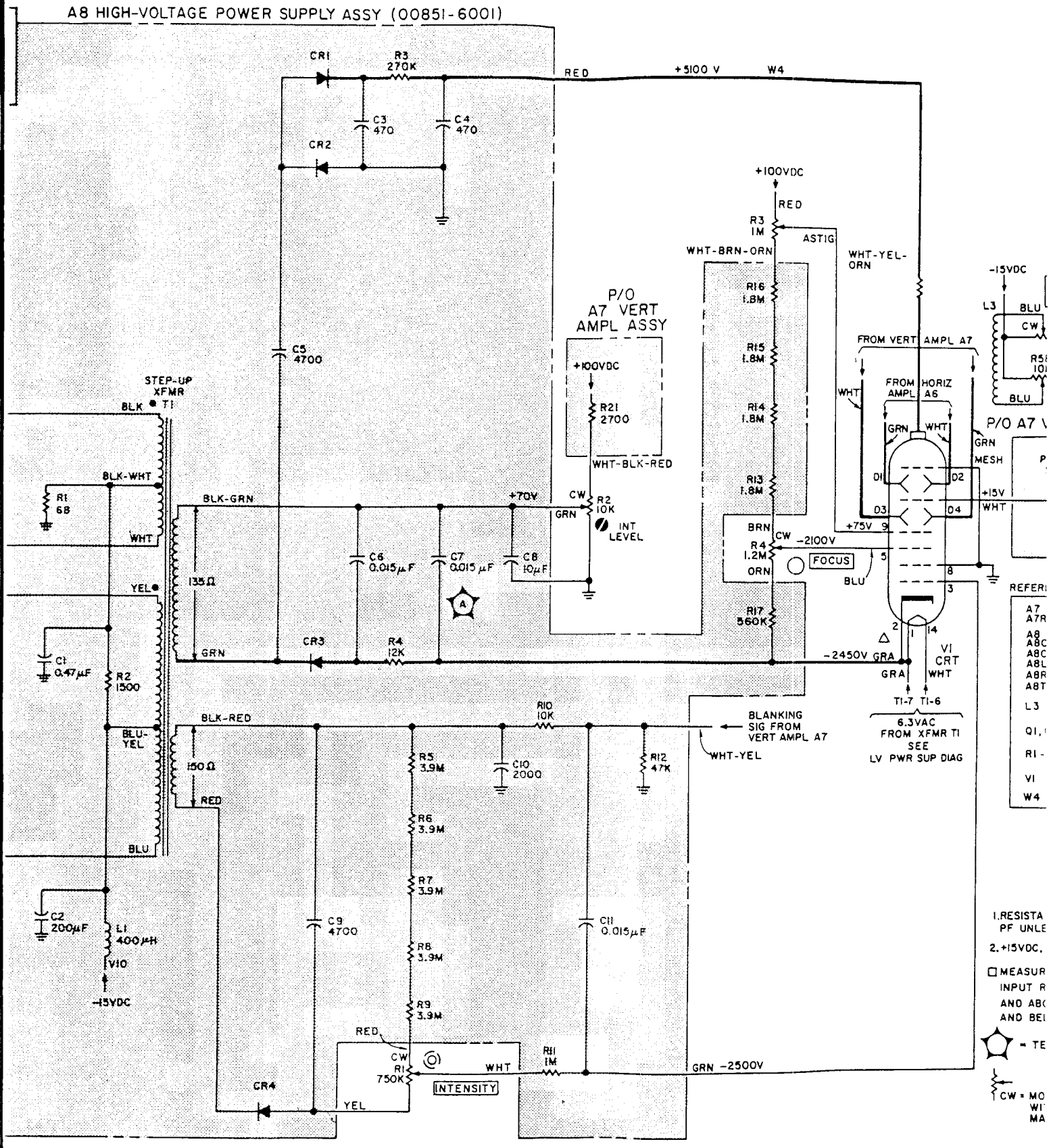
Table 5-28

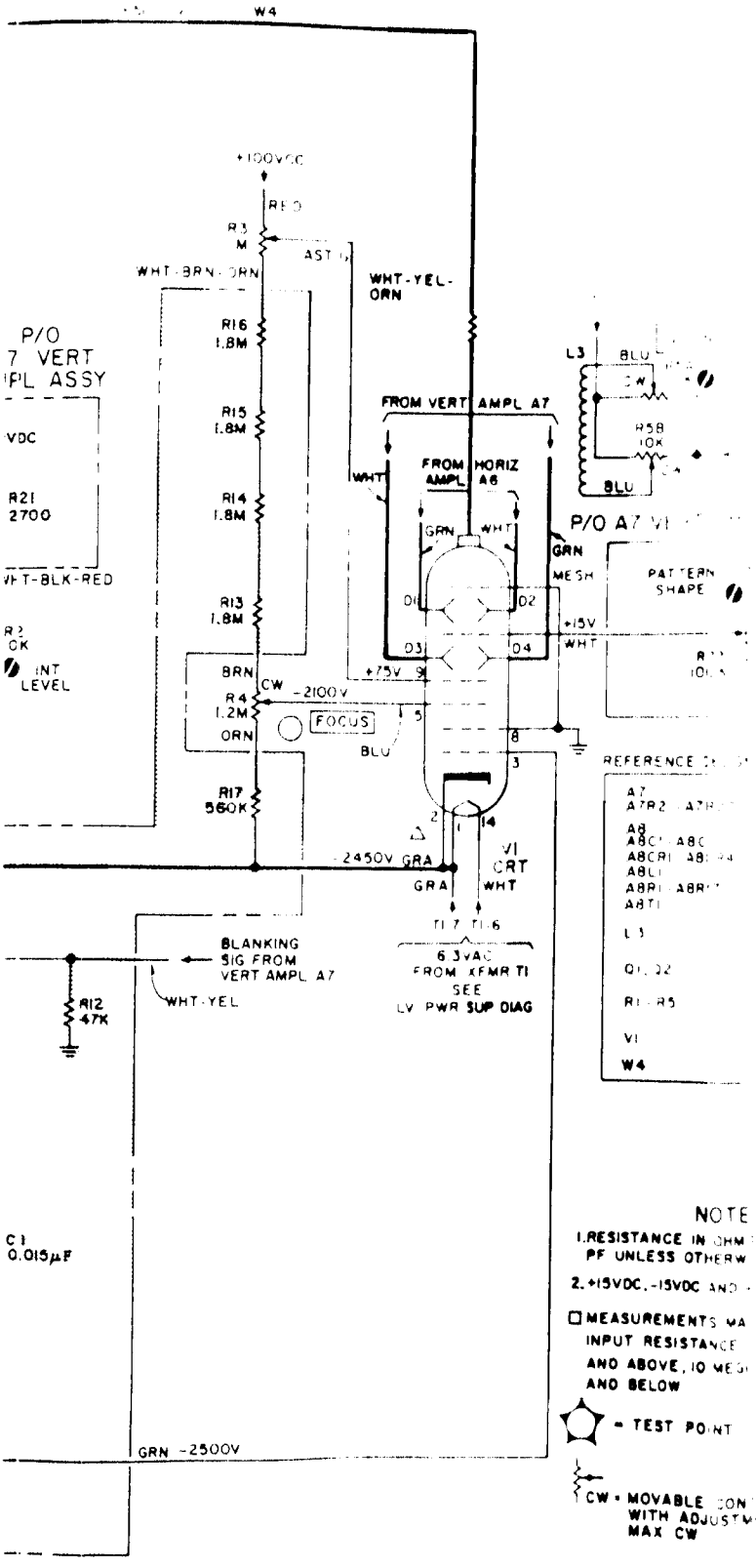
Table 5-29. Connections, HV Power Supply A8 Board

Ref* No.	Color Code	Connection	Fig. Ref	Ref* No.	Color Code	Connection	Fig. Ref
1	yel	To terminal on INTENSITY control R1	5-35	7	wht-brn-orn	To terminal on Astig adjust (R3)	5-35
2	wht-yel	From Vert Ampl A7 (blanking signal)	5-29	8	orn	To terminal on FOCUS control (R4)	↓
3	wht	From adjustable contact on INTENSITY control R1	5-35	9	brn	To terminal on FOCUS control (R3)	↓
4	grn	To grid, pin 3, CRT (V1)	↓	10	vio	From -15 vdc supply	5-37
5	red	To terminal on INTENSITY control R1	↓	11	red	To CRT post-accelerator anode	5-35
6	gra	To cathode, pin 2, CRT (V1)	↓	12	grn	To Int Level adjust (R2)	5-35

* Figure 5-34


A8 HIGH-VOLTAGE POWER SUPPLY ASSY (00851-6001)
REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMBLY DESIGNATION AS PREFIX TO FORM COMPLETE DESIGNATION. e.g., R1 OF ASSEMBLY A1 IS A1R1, AND IS LISTED A1R1 IN THE TABLE OF REPLACEABLE PARTS. DESIGNATIONS OF COMPONENTS NOT WITHIN ASSEMBLIES ARE COMPLETE AS SHOWN.
CR1
R3 270K
C3 470
C4 470
CR2
C5 4700
STEP-UP XFMR T1
BLK
BLK-WHT
R1 68
WHT
BLK-GRN
+70V
C6 0.015µF
C7 0.015µF
C8 10µF
135Ω
GRN
CR3
R4 12K
YEL
C1 0.47µF
R2 1500
BLU-YEL
BLK-RED
R10 10K
150Ω
RED
R5 3.9M
C10 2000
R6 3.9M
R7 3.9M
C9 4700
R8 3.9M
R9 3.9M
RED
CW R11 750K
WHT
R11 1M
INTENSITY
CR4
YEL
BLU
C2 200µF
L1 400µH
V10
+15VDC
26
29V
25
-14.7V
8V
+3.25V
Q1
Q2
Q1, Q2 SWITCH 2N1838
COPYRIGHT 1964 BY HEWLETT-PACKARD CO
8518-HVPS-


A8 HIGH-VOLTAGE POWER SUPPLY ASSY (00851-6001)
CR1
R3 270K
RED
+5100 V
W4
C3 470
C4 470
CR2
C5 4700
STEP-UP XFMR T1
BLK
BLK-WHT
R1 68
WHT
YEL
135Ω
GRN
C1 0.47μF
R2 1300
BLU-YEL
150Ω
RED
BLU
C2 200μF
L1 400μH
V10
-15VDC
+100VDC
P/O A7 VERT AMPL ASSY
R21 2700
WHT-BLK-RED
BLK-GRN
+70V
CW
R2 10K
INT LEVEL
GRN
C6 0.015μF
C7 0.015μF
C8 10μF
A
CR3
R4 12K
+100VDC
RED
R3 1M
ASTIG
WHT-BRN-ORN
WHT-YEL-ORN
R16 1.8M
R15 1.8M
R14 1.8M
R13 1.8M
BRN
CW -2100V
R4 1.2M
ORN
FOCUS
BLU
R17 560K
-2450V GRA
GRA
VI CRT
WHT
TI-7 TI-6
6.3VAC FROM XFMR TI SEE LV PWR SUP DIAG
-15VDC
L3
BLU
CW
BLU
FROM VERT AMPL A7
FROM HORIZ AMPL A6
WHT
GRN
WHT
GRN MESH
D1
D2
D3
D4
+15V
WHT
+75V
P/O A7
R10 10K
BLANKING SIG FROM VERT AMPL A7
WHT-YEL
R12 47K
R5 3.9M
R6 3.9M
R7 3.9M
R8 3.9M
R9 3.9M
C10 2000
C9 4700
C11 0.015μF
RED
CW
R1 750K
WHT
INTENSITY
R11 1M
GRN -2500V
CR4
YEL
1.RESISTA
PF UNLE
2.+15VDC.
MEASUR
INPUT R
AND ABC
AND BE
= TE
CW = MO
WI
MA



NOTE

1. RESISTANCE IN OHM
PF UNLESS OTHERW
2. +15VDC, -15VDC AND
MEASUREMENTS MA
INPUT RESISTANCE
AND ABOVE, 10 MEG
AND BELOW
= TEST POINT
CW = MOVABLE CON
WITH ADJUST
MAX CW

CONDITIONS OF MEA
MEASURE
VOLTMETER
SWEEP TIME
INTENSITY
INTENSITY MAX
SWEEP TIME
VERNIER MAX

Table 5-30. Connections, SYNC Switch S2, 851B

Ref No.	Color Code	Connection	Fig. Ref
1	coax	To contactor on wafer 1F; from base of A6Q1, p/o Schmitt Trigger in input to Sweep Generator	5-33
2	wht-grn-blu	Also connects to contactor on wafer 1F; from SINGLE SWEEP switch S3	
3	coax	Cable from SYNC INPUT J6 on rear panel connects here; wafer 1F; EXT position.	
4	blk	Chassis ground; connects to Sweep and Horiz Ampl board, point 30 (see Figure 5-31); wafer 1F, INT position; wafer 1R, SINGLE SWEEP, LINE, and EXT positions.	
5	grn	From A6Q7, p/o Reset Multivibrator, via A6R66; wafer 1F; SINGLE SWEEP position.	
6	grn	To A6Q22, amplifier in SINGLE SWEEP indicator lamp circuit; wafer 1F; SINGLE SWEEP position.	
7	gra	Conductor from Line Transformer T1 connects here; wafer 1F; LINE position.	5-37
8	wht	To contactor on wafer 1R; at INT, connects -15V to Reset Capacitors A10C1-A10C6 on SWEEP TIME, via A6R13.	5-33

1 S2, 851B

n	Fig. Ref
3Q1, p/o Schmitt Trigger	5-33
om SINGLE SWEEP	
connects here;	
riz Ampl board, point 30 n; wafer 1R, SINGLE SWEEP,	
A6R66; wafer 1F;	
idicator lamp circuit;	
nects here; wafer 1F;	5-37
s -15V to Reset Capacitors 13.	5-33

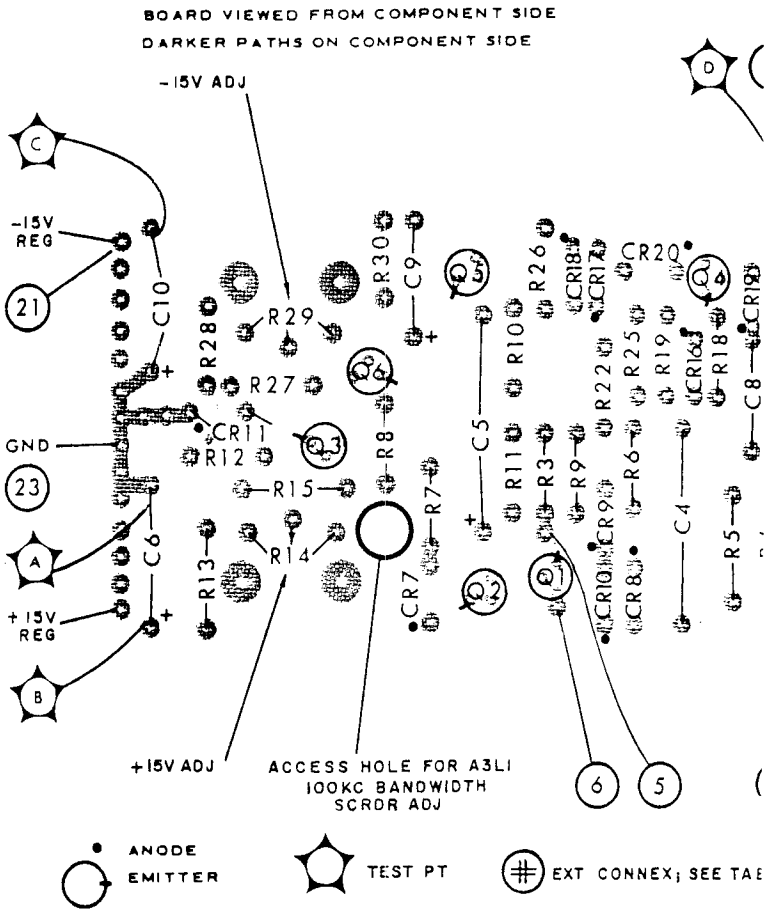


Figure 5-36. LV Power Supp

Table 5-30

Table 5-31. Connections, LV Powe

Ref* No.	Color Code	Connection	Fig. Ref	Ref* No.
1	red	+100 vdc regulated: to 851 circuits	5-37	15 16
2	blk	Chassis ground		17
3	wht-red-grn	To base of Emitter Foll Q5		18
4	wht-orn-yel	To emitter of Series Reg Q4		19
5	wht-orn-grn	To base of Series Reg Q4		20
6	wht-orn-blu	To coll of Series Reg Q4		
7	wht-red-yel	From T1-15		21
8	wht-red-yel	From T1-13		
9	wht-orn-blu	From T1-14		
10	wht-vio	To coll of Series Reg Q6 and Emitter Foll Q5		22
11	wht-brn-yel	To emitter of Series Reg Q6		
12	wht-blk-blu	To coll of Series Reg Q3		
13	wht-blk-grn	To base of Series Reg Q3		23
14	wht-blk-red	From T1-12		

* Figure 5-36

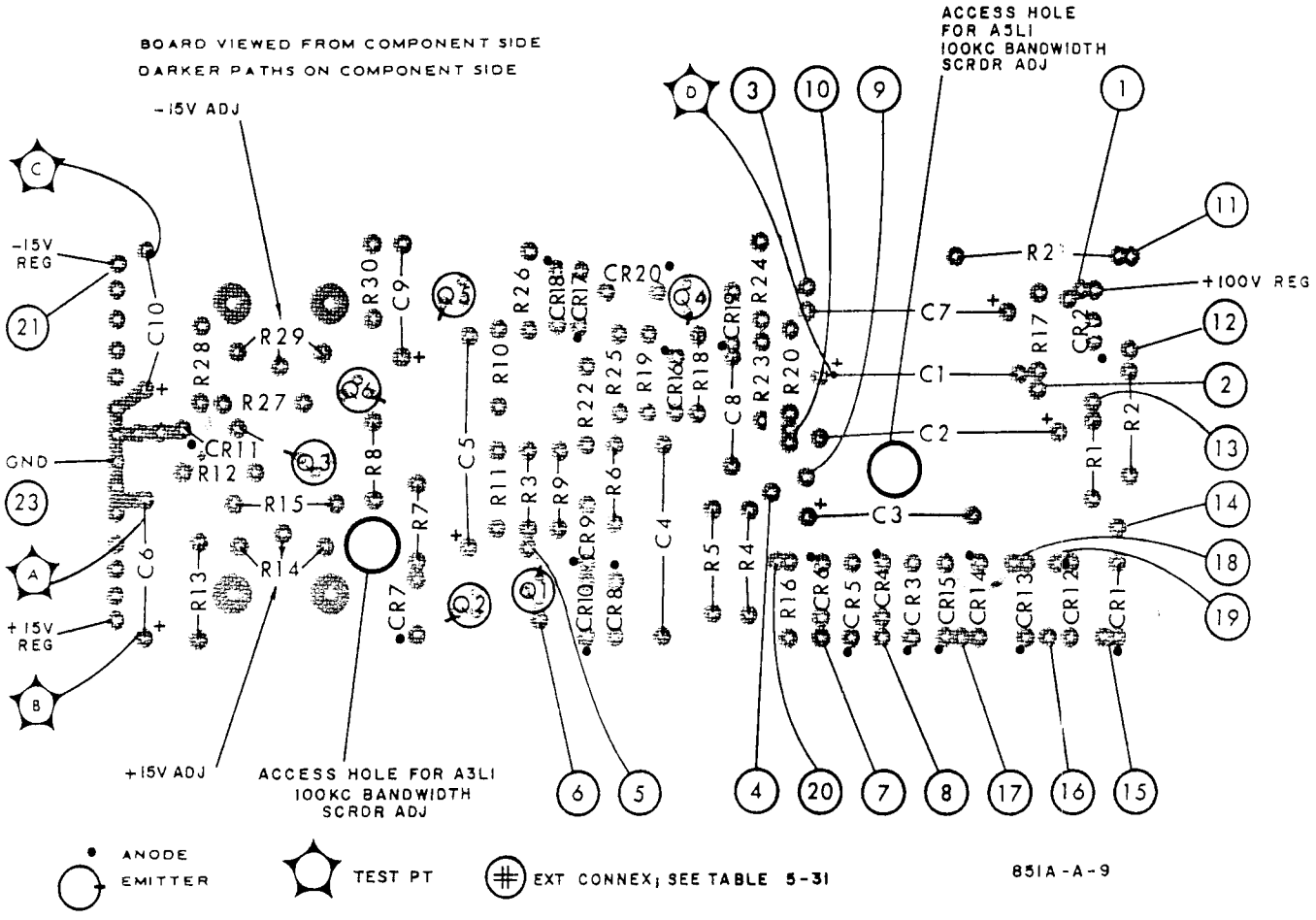


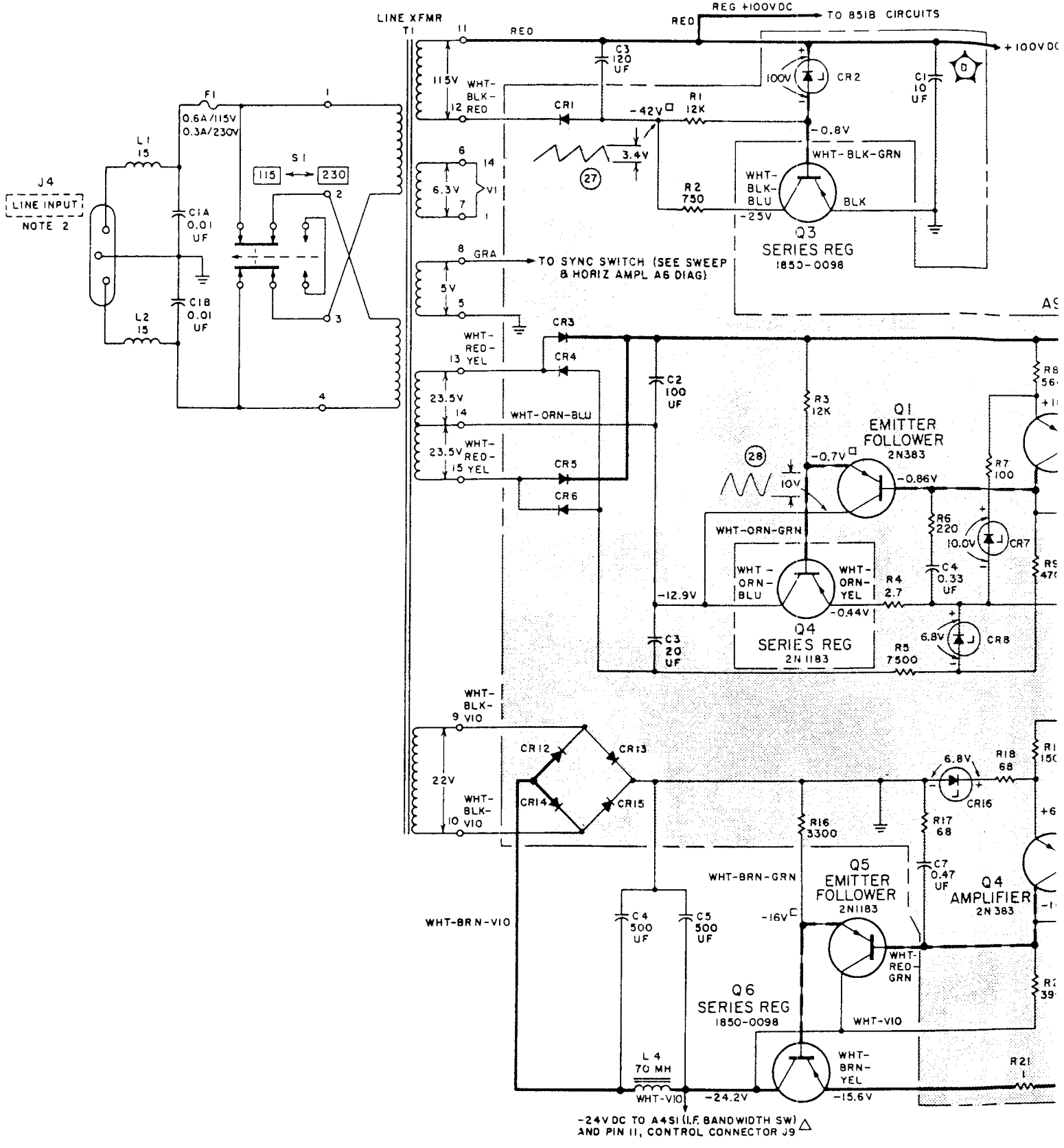
Figure 5-36. LV Power Supply A9 Board

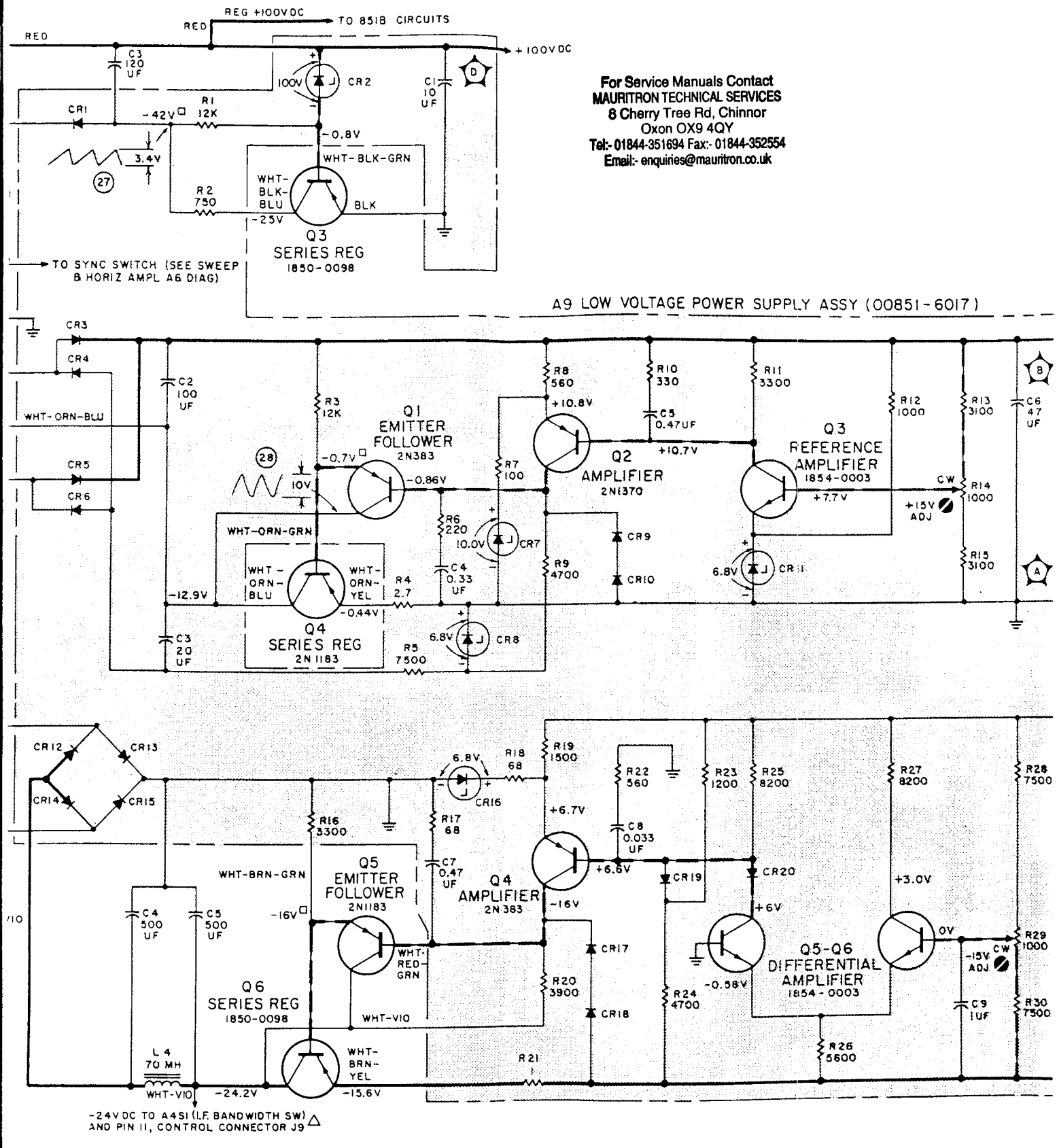
Table 5-30

Table 5-31. Connections, LV Power Supply A9 Board

Ref* No.	Color Code	Connection	Fig. Ref
1	red	+100 vdc regulated: to 851 circuits	5-37
2	blk	Chassis ground	
3	wht-red-grn	To base of Emitter Foll Q5	
4	wht-orn-yel	To emitter of Series Reg Q4	
5	wht-orn-grn	To base of Series Reg Q4	
6	wht-orn-blu	To coll of Series Reg Q4	
7	wht-red-yel	From T1-15	
8	wht-red-yel	From T1-13	
9	wht-orn-blu	From T1-14	
10	wht-vio	To coll of Series Reg Q6 and Emitter Foll Q5	
11	wht-brn-yel	To emitter of Series Reg Q6	
12	wht-blk-blu	To coll of Series Reg Q3	
13	wht-blk-grn	To base of Series Reg Q3	
14	wht-blk-red	From T1-12	
15	wht-blk-orn	From C3	5-37
16	wht-blk-vio	From T1-9	
17	wht-blk-vio	From T1-10	
18	blk	Chassis ground	
19	wht-brn-vio	To junction of C4 and L4	
20	wht-brn-grn	To junction of emitter of Q5 & base of Series Reg Q6	
21	vio	-15 vdc regulated: to filter in RF Ckt Assy A2	5-24
		to 851 circuits	5-37
		to 8551 circuits via J9-12	5-39
22	wht-red	+15 vdc regulated: to 851 circuits	5-37
		to 8551 circuits via J9-13	5-39
23	blk	Chassis ground to 8551 via J9-14	

* Figure 5-36


LINE XFMR T1
REG +100VDC
TO 851B CIRCUITS
+100VDC
J4
LINE INPUT
NOTE 2
F1
0.6A/115V
0.3A/230V
S1
115
230
L1
15
L2
15
C1A
0.01 UF
C1B
0.01 UF
C3
120 UF
C1
10 UF
CR1
CR2
100V
R1
12K
R2
750
Q3
SERIES REG
1850-0098
WHT-BLK-GRN
WHT-BLK-BLU
BLK
-0.8V
-25V
-42V
3.4V
115V
6.3V
5V
23.5V
23.5V
WHT-BLK-12 RED
WHT-RED-13 YEL
WHT-ORN-BLU
WHT-RED-15 YEL
GRA
TO SYNC SWITCH (SEE SWEEP & HORIZ AMPL A6 DIAG)
CR3
CR4
CR5
CR6
C2
100 UF
R3
12K
Q1
EMITTER FOLLOWER
2N383
-0.7V
-0.86V
10V
R7
100
R6
220
10.0V
CR7
WHT-ORN-GRN
WHT-ORN-BLU
WHT-ORN-YEL
C4
0.33 UF
R4
2.7
-12.9V
-0.44V
Q4
SERIES REG
2N1183
C3
20 UF
R5
7500
6.8V
CR8
WHT-BLK-9 VIO
WHT-BLK-10 VIO
22V
CR12
CR13
CR14
CR15
R16
3300
R17
68
R18
68
6.8V
CR16
C7
0.47 UF
Q5
EMITTER FOLLOWER
2N1183
Q4
AMPLIFIER
2N383
WHT-BRN-GRN
WHT-BRN-VIO
C4
500 UF
C5
500 UF
-16V
WHT-RED-GRN
Q6
SERIES REG
1850-0098
WHT-VIO
L4
70 MH
WHT-BRN-YEL
-24.2V
-15.6V
-24V DC TO A4S1 (I.F. BANDWIDTH SW) AND PIN 11, CONTROL CONNECTOR J9

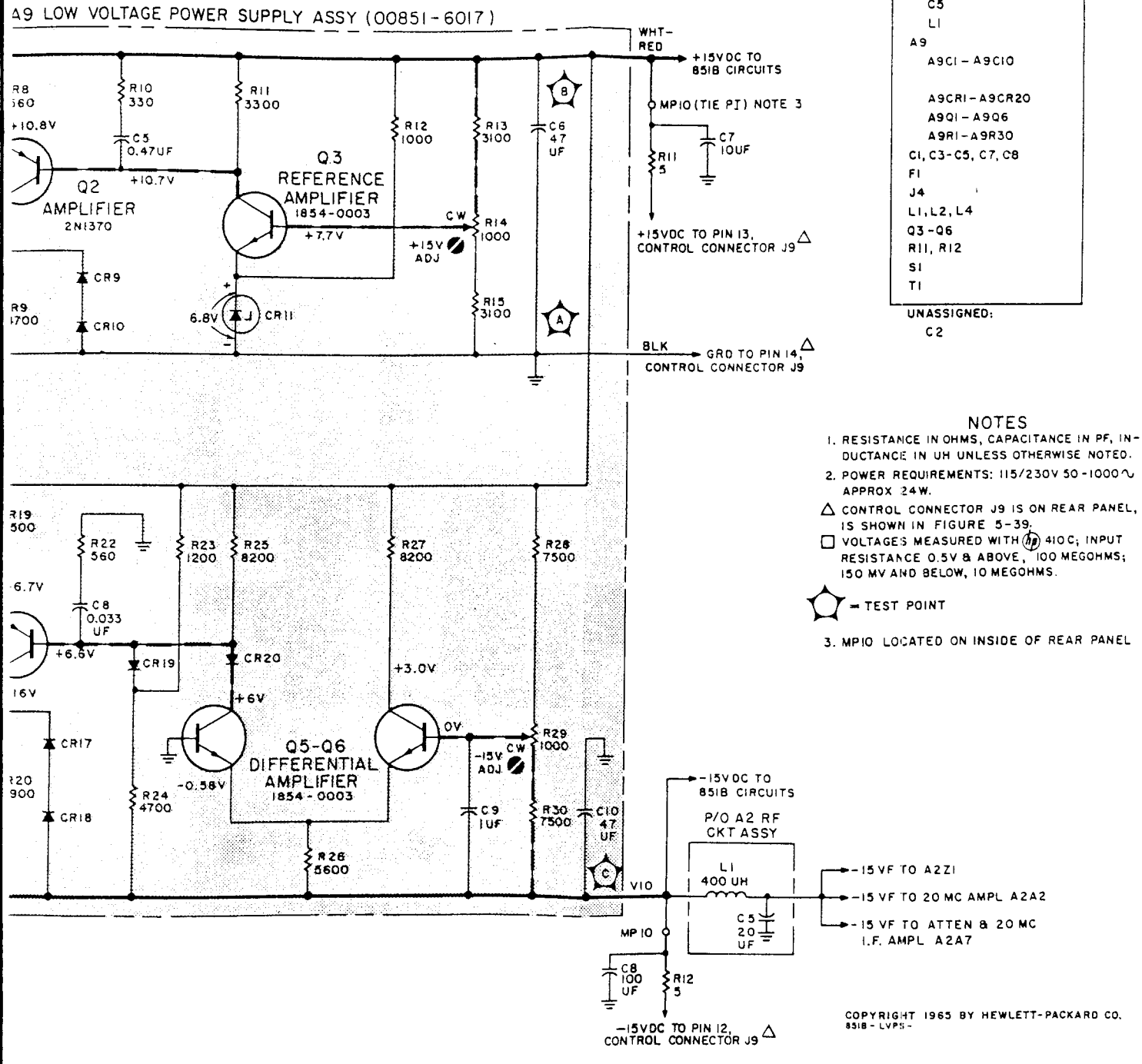


REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMELY DESIGNATION AS PREFIX TO FORM COMPLETE DESIGNATION. e.g., R1 OF ASSEMBLY A1 IS A1R1, AND IS LISTED A1R1 IN THE TABLE OF REPLACEABLE PARTS. DESIGNATIONS OF COMPONENTS NOT WITHIN ASSEMBLIES ARE COMPLETE AS SHOWN.

REFERENCE DESIGNATIONS

A2
C5
L1
A9
A9C1 – A9C10
A9CR1 – A9CR20
A9Q1 – A9Q6
A9R1 – A9R30
C1, C3 – C5, C7, C8
F1
J4
L1, L2, L4
Q3 – Q6
R11, R12
S1
T1

UNASSIGNED:
C2



NOTES

1. RESISTANCE IN OHMS, CAPACITANCE IN PF, INDUCTANCE IN UH UNLESS OTHERWISE NOTED.
2. POWER REQUIREMENTS: 115/230V 50-1000∿ APPROX 24W.
3. MP10 LOCATED ON INSIDE OF REAR PANEL

△ CONTROL CONNECTOR J9 IS ON REAR PANEL, IS SHOWN IN FIGURE 5-39.

□ VOLTAGES MEASURED WITH HP 410C; INPUT RESISTANCE 0.5V & ABOVE, 100 MEGOHMS; 150 MV AND BELOW, 10 MEGOHMS.

⬠ = TEST POINT

Figure 5-37. LV Power Supply Schematic, 851B

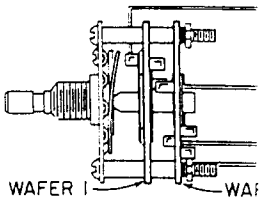
Table 5-32. Connections, I. F. BANDWIDTH Switch A4S1, 851B

Ref No.	Color Code	Connection	Fig. Ref
1	wht-orn-yel	-24V to tie point at A2Z3 on rear of A2 RF Circuit casting; energizes I. F. Bandwidth Switching relays A2A4K2, A2A3K1, and filter-switching relay A7K2.	5-24 5-26 5-29
2	wht-blk-yel	To SWEEP TIME switch, wafer 4F, on which connection is made to leads outgoing to CONTROL connector J9*.	5-30
3	wht-orn-blu	-24V to tie point at A2Z2 on A2 casting rear; energizes relays A2A4K1, A2A3K2, A7K1, A7K4.	5-24 5-26 5-29
4	wht-blk-blu	To SWEEP TIME switch, wafer 4R, on which connection is made to leads outgoing to CONTROL connector J9*.	5-30
5	wht-orn-vio	-24V to tie point at A2Z4 on A2 casting rear; energizes relays A2A5K1, A2A1K2, A7K1, A7K3, A7K4.	5-24 5-26 5-29
6	wht-blk-vio	To SWEEP TIME switch, wafer 5F, on which connection is made to leads outgoing to CONTROL connector J9*.	5-30
7	wht-orn-grn	-24V to tie point at A2Z5 on A2 casting rear; energizes relays A2A5K2, A2A1K1, A7K1.	5-24 5-26 5-29
8	wht-blk-grn	To SWEEP TIME switch, wafer 5R, on which connection is made to leads outgoing to CONTROL connector J9*.	5-30
9	wht-vio	-24VDC from LV Power Supply A9	5-37

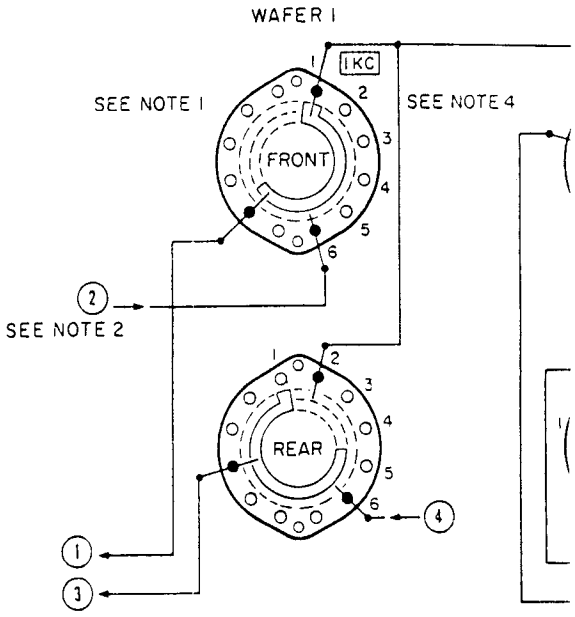
* For AUTO SELECT operation; via inter-unit CONTROL cable, connection is made to SWEEP TIME switch in 8551 RF Section.

BANDWIDTH Switch A4S1, 851B

Connection	Fig. Ref
3 on rear of A2 RF Circuit casting; ith Switching relays A2A4K2, A2A3K1, lay A7K2.	5-24 5-26 5-29
., wafer 4F, on which connection is made)NTROL connector J9*.	5-30
2 on A2 casting rear: energizes relays <1, A7K4.	5-24 5-26 5-29
., wafer 4R, on which connection is made)NTROL connector J9*.	5-30
4 on A2 casting rear; energizes relays <1, A7K3, A7K4	5-24 5-26 5-29
., wafer 5F, on which connection is made)NTROL connector J9*.	5-30
5 on A2 casting rear; energizes relays <1	5-24 5-26 5-29
., wafer 5R, on which connection is made)NTROL connector J9*.	5-30
· Supply A9	5-37
unit CONTROL cable, connection is made on.	



I.F. BANDWIDTH SWITCH



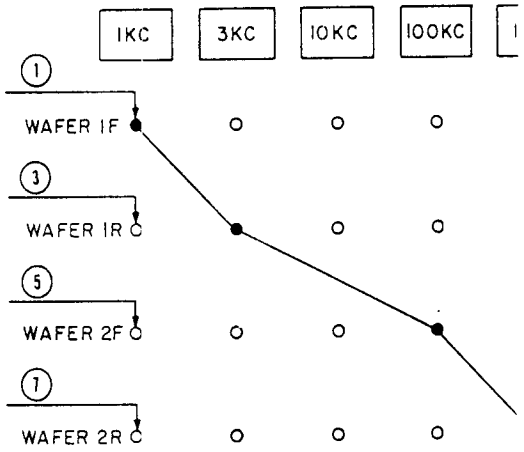
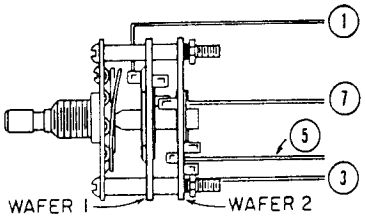
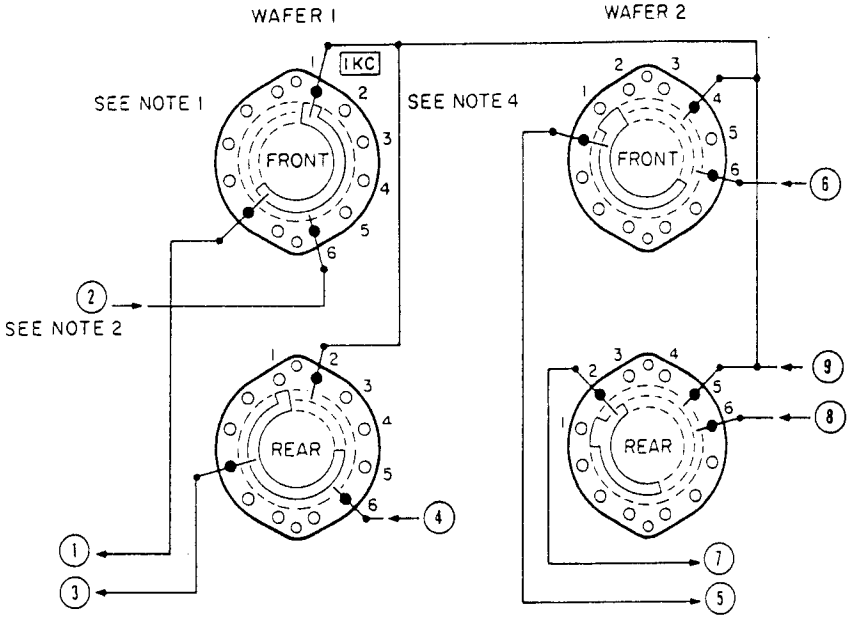


Figure 5-38.



I.F. BANDWIDTH SWITCH A4S1



NOTES

1. SWITCH VIEWED FROM KNOB END, IN MAX CCW POSITION (1KC)

CODE	A4S1 POS
1	1KC
2	3KC
3	10KC
4	100KC
5	1MC
6	AUTO SELECT

2. SEE TABLE 5-32

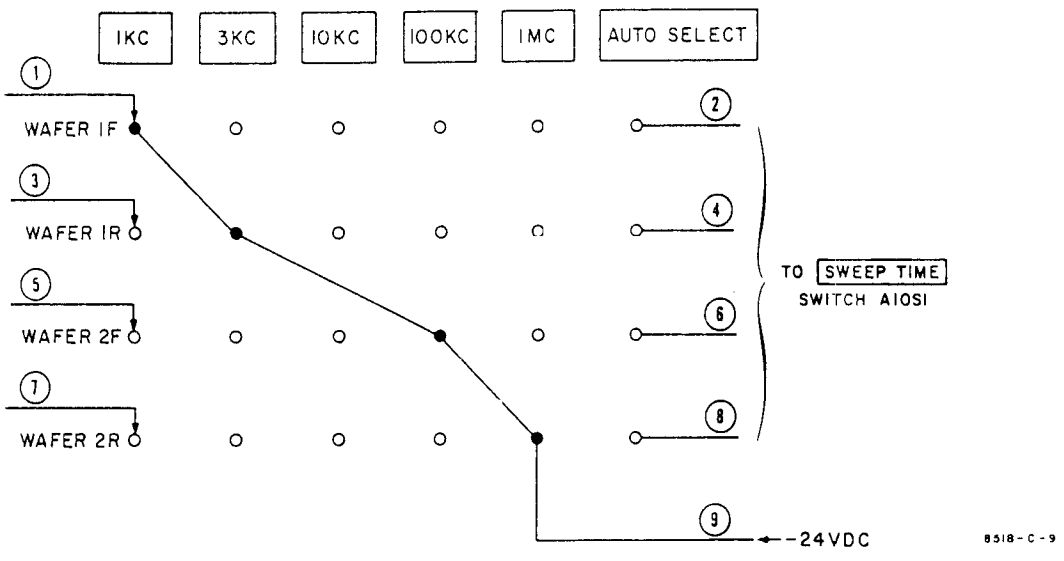
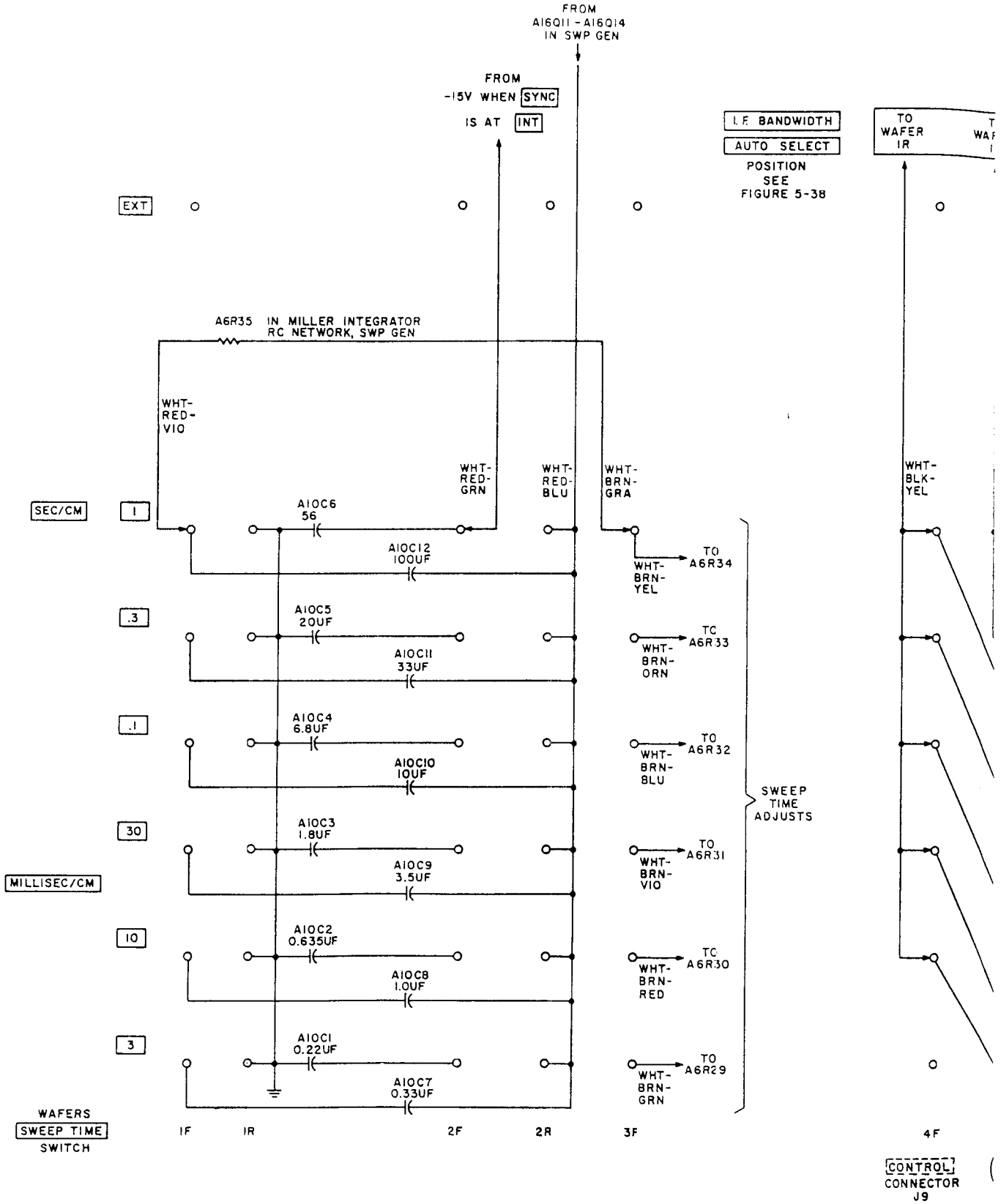
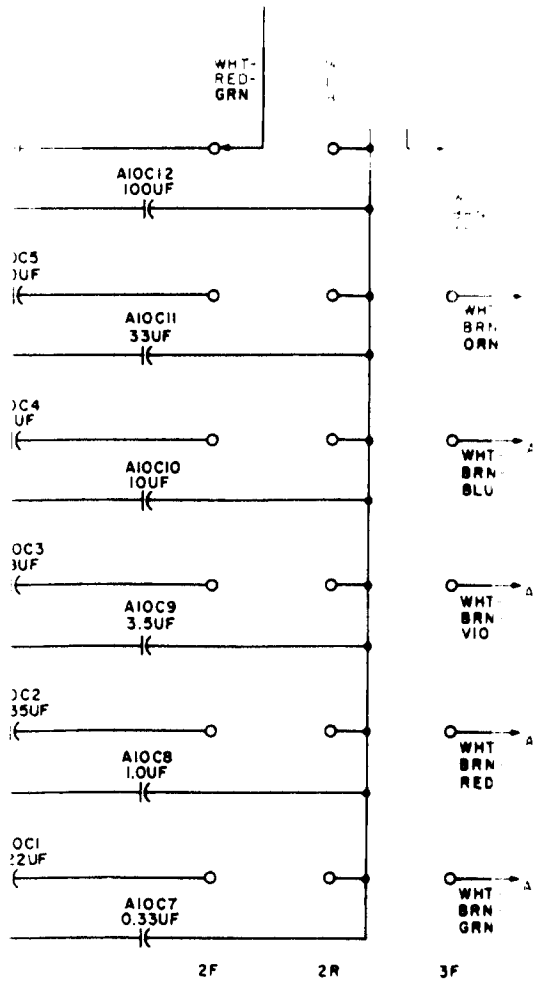


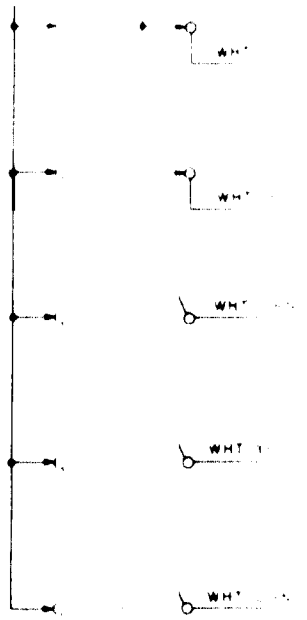
Figure 5-38. I. F. BANDWIDTH Switch A4S1

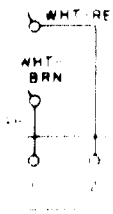

FROM
A16Q11 - A16Q14
IN SWP GEN
FROM
-15V WHEN SYNC
IS AT INT
I.F. BANDWIDTH
AUTO SELECT
POSITION
SEE
FIGURE 5-38
TO
WAFER
IR
EXT
A6R35 IN MILLER INTEGRATOR
RC NETWORK, SWP GEN
WHT-
RED-
VIO
WHT-
RED-
GRN
WHT-
RED-
BLU
WHT-
BRN-
GRA
WHT-
BLK-
YEL
SEC/CM
1
A10C6
56
A10C12
100UF
TO
A6R34
WHT-
BRN-
YEL
.3
A10C5
20UF
A10C11
33UF
TO
A6R33
WHT-
BRN-
ORN
.1
A10C4
6.8UF
A10C10
10UF
TO
A6R32
WHT-
BRN-
BLU
SWEEP
TIME
ADJUSTS
30
A10C3
1.8UF
A10C9
3.5UF
TO
A6R31
WHT-
BRN-
VIO
MILLISEC/CM
10
A10C2
0.635UF
A10C8
1.0UF
TO
A6R30
WHT-
BRN-
RED
3
A10C1
0.22UF
A10C7
0.33UF
TO
A6R29
WHT-
BRN-
GRN
WAFERS
SWEEP TIME
SWITCH
1F
1R
2F
2R
3F
4F
CONTROL
CONNECTOR
J9

02148-1

8 Chr
Tel: 01844
Email: enquiries@







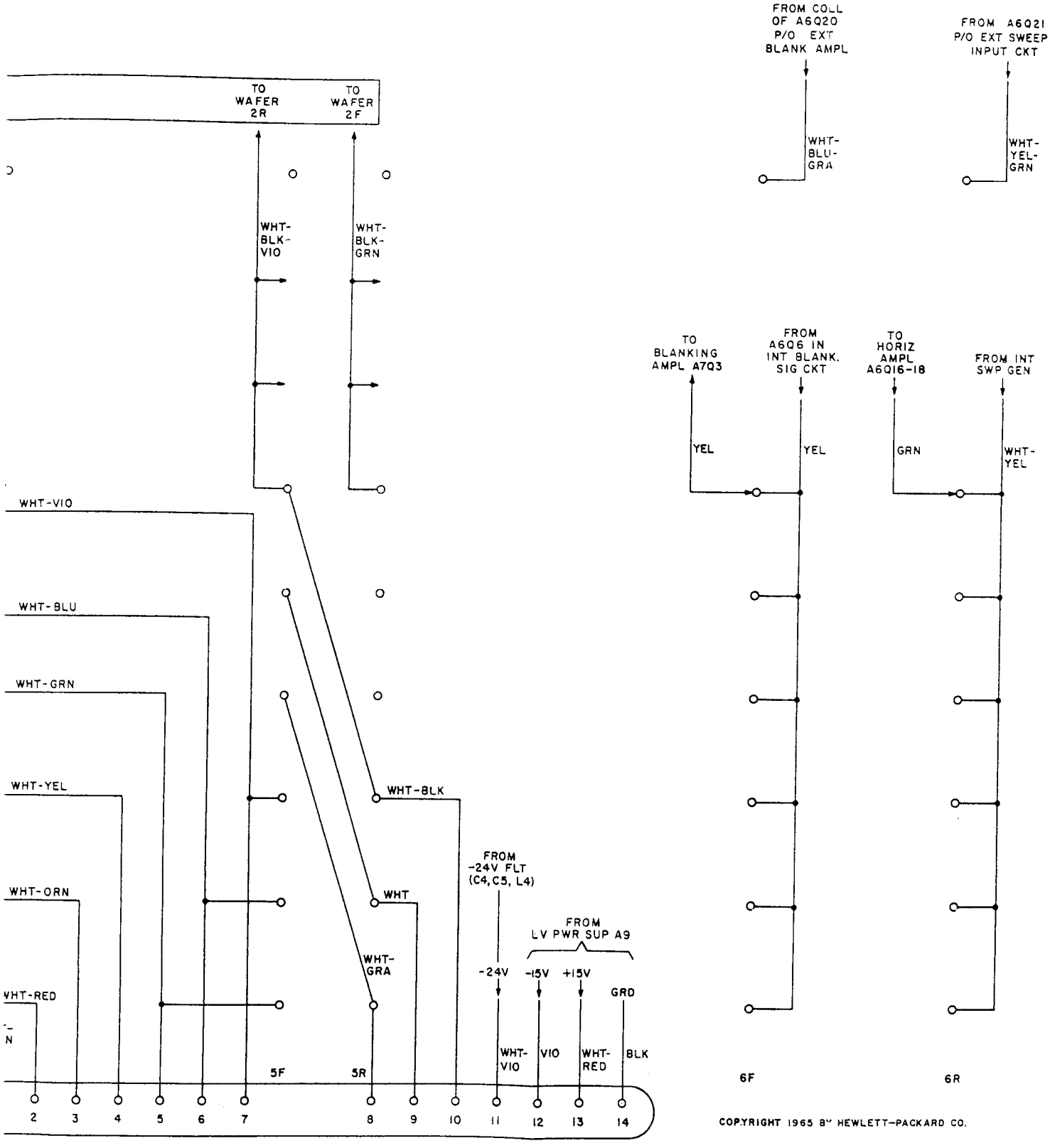


Figure 5-39. 851B SWEEP TIME Switch A10S1, Schematic

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts.

6-3. Tables 6-1 and 6-2 list parts in the alpha-numerical order of their reference designations and give the Hewlett-Packard stock number and description for each part, together with any applicable notes. Miscellaneous parts not assigned a reference designation are listed at the end of the Table which covers the Assembly with which the part is associated. Reference Designation Index Tables cover the following Assemblies:

Table 6-1. Assemblies A1, A3 through A12, and parts mounted on the chassis
Table 6-2. RF Circuit Assembly A2

6-4. Table 6-3 lists parts in the alpha-numerical order of their hp Stock Numbers, and provides the following information on each part: 1) description of part (see list of abbreviations below), 2) typical manufacturer of part in five-digit code (see code list of manufacturers in Appendix), 3) manufacturer's stock number, 4) total quantity used in instrument (TQ col).

6-5. ORDERING INFORMATION.

6-6. To order a replacement part, address order or inquiry to your nearest Hewlett-Packard sales and service office. Addresses of sales and service offices around the world are given at the rear of this manual.

6-7. Specify the following for each part: 1) model and complete serial number of instrument, 2) Hewlett-Packard stock number, 3) reference designation, and 4) description.

6-8. When ordering from Hewlett-Packard always furnish the hp stock number. The part you receive may not be made by the manufacturer listed but will be electrically and mechanically interchangeable, and performance will be equal. Manufacturer's part number is listed for your convenience should you want to order directly.

6-9. To order a part not listed, give complete description of the part and include its function and location.

REFERENCE DESIGNATORS

A = assembly	E = misc electronic part	MP = mechanical part	TB = terminal board
B = motor	F = fuse	P = plug	TP = test point
C = capacitor	FL = filter	Q = transistor	V = vacuum tube, neon bulb, photocell, etc.
CP = coupling	J = jack	R = resistor	
CR = diode	K = relay	RT = thermistor	W = cable
DL = delay line	L = inductor	S = switch	X = socket
DS = device signaling (lamp)	M = meter	T = transformer	Y = crystal

ABBREVIATIONS

A = amperes	GE = germanium	N/C = normally closed	RMO = rack mount only
A.F.C = automatic frequency control	GL = glass	NE = neon	RMS = root-mean-square
AMPL = amplifier	GRD = ground(ed)	NI PL = nickel plate	
		N/O = normally open	S-B = slow-blow
B.F.O. = beat frequency oscillator	H = henries	NPO = negative positive zero (zero temperature coefficient)	SCR = screw
BE CU = beryllium copper	HEX = hexagonal		SE = selenium
BH = binder head	HG = mercury		SECT = section(s)
BP = bandpass	HR = hour(s)	NRFR = not recommended for field replacement	SEMICON = semiconductor
BRS = brass			SI = silicon
BWO = backward wave oscillator	IF = intermediate freq	NSR = not separately replaceable	SIL = silver
	IMPG = impregnated		SL = slide
CCW = counter-clockwise	INCD = incandescent		SPL = special
CER = ceramic	INCL = include(s)	OBD = order by description	SST = stainless steel
CMO = cabinet mount only	INS = insulation(ed)	OH = oval head	SR = split ring
COEF = coefficient	INT = internal	OX = oxide	STL = steel
COM = common			
COMP = composition	K = kilo = 1000	P = peak	TA = tantalum
CONN = connector		PC = printed circuit	TD = time delay
CP = cadmium plate	LIN = linear taper	PF = picofarads = 10^{-12} farads	TGL = toggle
CRT = cathode-ray tube	LK WASH = lock washer		TI = titanium
CW = clockwise	LOG = logarithmic taper	PH BRZ = phosphor bronze	TOL = tolerance
	LPF = low pass filter	PHL = Phillips	TRIM = trimmer
DEPC = deposited carbon		PIV = peak inverse voltage	TWT = traveling wave tube
DR = drive	M = milli = 10^{-3}	P/O = part of	
	MEG = meg = 10^{6}	POLY = polystyrene	U = micro = 10^{-6}
ELECT = electrolytic	METFLM = metal film	PORC = porcelain	
ENCAP = encapsulated	MFR = manufacturer	POS = position(s)	VAR = variable
EXT = external	MINAT = miniature	POT = potentiometer	VDCW = dc working volts
	MOM = momentary	PP = peak-to-peak	
F = farads	MTG = mounting	PT = point	W/ = with
FH = flat head	MY = "mylar"	RECT = rectifier	W = watts
FIL H = fillister head		RF = radio frequency	WW = wirewound
FXD = fixed	N = nano (10^{-9})	RH = round head	W/O = without

Table 6-1. Reference Designation Index, General

Reference Designation	Stock No.	Description #	Note
A1	00851-6002	SWITCH ASSY:IF GAIN (DB)	
A1R1	0727-0036	R:FXD DEPC 71.16 OHM 1% 1/2W	
A1R2	0727-0042	R:FXD DEPC 96.25 OHM 1/2% 1/2W	
A1R3	0727-0042	R:FXD DEPC 96.25 OHM 1/2% 1/2W	
A1R4	0727-0062	R:FXD DEPC 247.5 OHM 1/2% 1/2W	
A1R5	0727-0033	R:FXD DEPC 61.11 OHM 1% 1/2W	
A1R6	0727-0033	R:FXD DEPC 61.11 OHM 1% 1/2W	
A1R7	0727-0122	R:FXD DEPC 2.51K OHM 1% 1/2W	
A1R8	0727-0025	R:FXD DEPC 51.5 OHM 1% 1/2W	
A1R9	0727-0025	R:FXD DEPC 51.5 OHM 1% 1/2W	
A1R10	0727-0005	R:FXD DEPC 5.77 OHM 1/2% 1/2W	
A1R11	0727-0094	R:FXD DEPC 870 OHM 1/2% 1/2W	
A1R12	0727-0094	R:FXD DEPC 870 OHM 1/2% 1/2W	
A1R13	0727-0008	R:FXD DEPC 11.61 OHM 1/2% 1/2W	
A1R14	0727-0074	R:FXD DEPC 436 OHM 1/2% 1/2W	
A1R15	0727-0074	R:FXD DEPC 436 OHM 1/2% 1/2W	
A1R16	0727-0010	R:FXD DEPC 17.61 OHM 1/2% 1/2W	
A1R17	0727-0063	R:FXD DEPC 292.5 OHM 1% 1/2W	
A1R18	0727-0063	R:FXD DEPC 292.5 OHM 1% 1/2W	
A1R19	0727-0017	R:FXD DEPC 37.35 OHM 1/2% 1/2W	
A1R20	0727-0048	R:FXD DEPC 150 OHM 1% 1/2W	
A1R21	0727-0048	R:FXD DEPC 150 OHM 1% 1/2W	
A1S1	3100-0812	ROTARY SWITCH IF GAIN SWITCH	
	00851-0014	COVER:SWITCH IF GAIN	
	00851-0015	PLATE, COVER IF GAIN	
	00851-0016	BRACKET:IF GAIN (DB) SWITCH	
	00851-2027	KNOB:IF GAIN 0-70 DB	
A1S2	3100-0812	ROTARY SWITCH IF GAIN SWITCH	
	00851-0014	COVER:SWITCH IF GAIN	
	00851-0015	PLATE, COVER IF GAIN	
	00851-2028	KNOB:IF GAIN 0-10 DB	
A1W1	00851-6014	CABLE ASSY:ATTEN INPUT 13-INCH COAX W/BNC MALE PLUG P1	
A1W2	00851-6013	CABLE ASSY:ATTEN OUTPUT 12-INCH COAX W/BNC MALE PLUG P2	
A2	00851-6003	RF CIRCUIT ASSEMBLY SEE TABLE 6-2 FOR LISTING OF COMPONENTS	
	00851-2022	CAVITY:FILTER,P/O A3	
A3	00851-6028	FILTER ASSY.:100KC BAND-PASS	
	08551-2083	BUSHING	
A3C1	0160-0822	C:FXD TI 2.2PF 5% 500VDCW	
A3J1	1250-0228	CONNECTOR:RF JACK CHASSIS	
A3J2	1250-0228	CONNECTOR:RF JACK CHASSIS	
A3L1	00851-6008	COIL:RF VARIABLE	
A4S1	00851-6007	SWITCH ASSY.:I.F. BANDWIDTH	
	0370-0112	KNOB:I F BANDWIDTH	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index, General (cont'd)

Reference Designation	℗ Stock No.	Description #	Note
	00851-2022	CAVITY:FILTER, P/O A5	
A5	00851-6028	FILTER ASSY.:100KC BAND-PASS	
	08551-2083	BUSHING	
A5C1	0160-0822	C:FXD TI 2.2PF 5% 500VDCW	
A5J1	1250-0228	CONNECTOR:RF JACK CHASSIS	
A5J2	1250-0228	CONNECTOR:RF JACK CHASSIS	
A5L1	00851-8008	COIL:RF VARIABLE	
A6	00851-6038	BOARD ASSY: SWEEP & HORIZ AMPL	
A6C1	0140-0207	C:FXD MICA 330PF 5% 500VDCW	
A6C2	0140-0180	C:FXD MICA 2000 PF 2% 300 VDCW	
A6C3	0160-0174	C:FXD CER 0.47UF 80% 25VDCW	
A6C4	0140-0207	C:FXD MICA 330PF 5% 500VDCW	
A6C5	0140-0207	C:FXD MICA 330PF 5% 500VDCW	
A6C6	0150-0121	C:FXD CER 0.1UF 50 VDCW	
A6C7	0170-0064	C:FXD MY 0.47UF 10% 100VDCW	
A6C8	0170-0079	C:FXD MY 0.047UF 20% 50VDCW	
A6CR1	1901-0096	SEMICON DEVICE:DIODE SILICON	
A6CR2	1901-0096	SEMICON DEVICE:DIODE SILICON	
A6CR3	1901-0096	SEMICON DEVICE:DIODE SILICON	
A6CR4	1902-0050	SEMICON DEVICE:DIODE SI JUNC 8.66V 5%	
A6Q1	1851-0017	TRANSISTOR:2N1304	
A6Q2	1851-0017	TRANSISTOR:2N1304	
A6Q3	1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	
A6Q4	1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	
A6Q5	1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	
A6Q6	1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	
A6Q7	1851-0017	TRANSISTOR:2N1304	
A6Q8	1851-0017	TRANSISTOR:2N1304	
A6Q9	1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	
A6Q10	1851-0017	TRANSISTOR:2N1304	
A6Q11	1854-0003	TRANSISTOR:NPN SILICON	
A6Q12	1854-0003	TRANSISTOR:NPN SILICON	
A6Q13	1850-0065	TRANSISTOR:GERMANIUM 2N1370	
A6Q14	1850-0065	TRANSISTOR:GERMANIUM 2N1370	
A6Q15	1850-0065	TRANSISTOR:GERMANIUM 2N1370	
A6Q16	1854-0022	TRANSISTOR:NPN SILICON	
A6Q17	1854-0022	TRANSISTOR:NPN SILICON	
A6Q18	1851-0017	TRANSISTOR:2N1304	
A6Q19	1854-0003	TRANSISTOR:NPN SILICON	
A6Q20	1854-0003	TRANSISTOR:NPN SILICON	
A6Q21	1854-0033	TRANSISTOR:SILICON NPN	
A6Q22	1854-0022	TRANSISTOR:NPN SILICON	
A6R1	0684-1031	R:FXD COMP 10K OHM 10% 1/4W	
A6R2	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A6R3	0727-0124	R:FXD DEPC 3000 OHM 1% 1/2W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index, General (cont'd)

Reference Designation	Stock No.	Description #	Note
A6R4	0683-9115	R:FXD COMP 910 OHM 5% 1/4W	
A6R5	0727-0163	R:FXD DEPC 11.88K OHM 1% 1/2W	
A6R6	0727-0173	R:FXD DEPC 20K OHM 1% 1/2W	
A6R7	0684-1011	R:FXD COMP 100 OHM 10% 1/4W	
A6R8	0727-0158	R:FXD DEPC. 10.1K OHM 1% 1/2W	
A6R9	0727-0136	R:FXD DEPC 5.03K OHM 1% 1/2W	
A6R10	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A6R11	0683-4735	R:FXD COMP 47K OHM 5% 1/4W	
A6R12	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A6R13	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R14	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
A6R15	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A6R16	0684-4711	R:FXD COMP 470 OHM 10% 1/4W	
A6R17	0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	
A6R18	0683-1635	R:FXD COMP 16K OHM 5% 1/4W	
A6R19	0683-2435	R:FXD COMP 24K OHM 5% 1/4W	
A6R20	0683-2435	R:FXD COMP 24K OHM 5% 1/4W	
A6R21	0683-1635	R:FXD COMP 16K OHM 5% 1/4W	
A6R22	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A6R23	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A6R24	0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	
A6R25	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
A6R26	0683-1535	R:FXD COMP 15K OHM 5% 1/4W	
A6R27	0727-0158	R:FXD DEPC. 10.1K OHM 1% 1/2W	
A6R28	0727-0136	R:FXD DEPC 5.03K OHM 1% 1/2W	
A6R29	2100-0910	R:VAR COMP 2X35K OHM LIN 20% 1/4W	
A6R30	2100-0910	R:VAR COMP 2X35K OHM LIN 20% 1/4W	
A6R31	2100-0910	R:VAR COMP 2X35K OHM LIN 20% 1/4W	
A6R32	2100-0910	R:VAR COMP 2X35K OHM LIN 20% 1/4W	
A6R33	2100-0910	R:VAR COMP 2X35K OHM LIN 20% 1/4W	
A6R34	2100-0910	R:VAR COMP 2X35K OHM LIN 20% 1/4W	
A6R35	0758-0051	R:FXD MET FLM 43K OHM 5% 1/2W	
A6R36	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A6R37	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A6R38	0758-0002	R:FXD MET FLM 560 OHM 5% 1/2W	
A6R39	0758-0038	R:FXD MET FLM 9100 OHM 5% 1/2W	
A6R40	0683-1205	R:FXD COMP 12 OHM 5% 1/4W	
A6R41	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A6R42	0683-1535	R:FXD COMP 15K OHM 5% 1/4W	
A6R43	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A6R44	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R45	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A6R46	0683-1215	R:FXD COMP 120 OHM 5% 1/4W	
A6R47	0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	
A6R48	0758-0057	R:FXD MET FLM 5600 OHM 5% 1/2W	
A6R49	0727-0189	R:FXD DEPC 41.7K OHM 1% 1/2W	
A6R50	0687-1041	R:FXD COMP 100K OHM 10% 1/2W	
A6R51	0758-0034	R:FXD MET FLM 2400 OHM 5% 1/2W	
A6R52	0758-0004	R:FXD MET FLM 2700 OHM 5% 1/2W	
A6R53	0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	
A6R54	2100-0144	R:VAR COMP 250K OHM 30% LIN 2/5W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index, General (cont'd)

Reference Designation	Stock No.	Description #	Note
A6R55	0758-0034	R:FXD MET FLM 2400 OHM 5% 1/2W	
A6R56	0727-0189	R:FXD DEPC 41.7K OHM 1% 1/2W	
A6R57	0758-0022	R:FXD MET FLM 82K OHM 5% 1/2W	
A6R58	0758-0044	R:FXD MET FLM 2200 OHM 5% 1/2W	
A6R59	0758-0012	R:FXD MET FLM 12K OHM 5% 1/2W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A6R60	0758-0044	R:FXD MET FLM 2200 OHM 5% 1/2W	
A6R61	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A6R62	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A6R63	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A6R64	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
A6R65	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A6R66	0683-3335	R:FXD COMP 33K OHM 5% 1/4W	
A6R67	0683-3335	R:FXD COMP 33K OHM 5% 1/4W	
A6R68	0683-3935	R:FXD COMP 39K OHM 5% 1/4W	
A6R69	2100-0092	R:VAR COMP 10K OHM 20% LIN 1/5W	
A6R70	0683-1345	R:FXD COMP 130K OHM 5%A1/4W	
A6R71	0683-2025	R:FXD COMP 2000 OHM 5% 1/4W	
A6R72	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A6RT1	0852-0021	R:TEMPERATURE COMPENSATING 100 OHM 5% 25C	
A6TB1	00851-2005	BLANK PC BOARD, SWEEP & HORIZ AMPL	
A6W1	00851-6032	CABLE ASSY. 8-IN COAX:SYNC SWITCH-SWEEP AMPL A6	
A6W2	00851-6036	CABLE ASSY:HORIZ. OUTPUT TO CRT 12-INCH CABLE TERM. W/FEMALE PIN	
A7	00851-6019	BOARD ASSY:VERT. AMPL. ASSY.	
A7C1	0150-0096	C:FXD CER 0.05UF 100VDCW	
A7C2	0160-0174	C:FXD CER 0.47UF 80% 25VDCW	
A7C3	0170-0086	C:FXD MY 0.22UF 20% 50VDCW	
A7C4	0170-0083	C:FXD MY 0.022UF 20% 50VDCW	
A7C5	0140-0160	C:FXD MICA 3400 PF 5% 500 VDCW	
A7C6	0170-0084	C:FXD MY 0.068UF 20% 50VDCW	
A7C7	0170-0018	C:FXD MY 1UF 5% 200VDCW	
A7C8	0150-0121	C:FXD CER 0.1UF 50 VDCW	
A7C9	0160-0174	C:FXD CER 0.47UF 80% 25VDCW	
A7CR1	1902-0025	SEMICON DEVICE:DIODE SILICON	
A7CR2	1901-0096	SEMICON DEVICE:DIODE SILICON	
A7CR3	1902-0017	SEMICON DEVICE:DIODE SI	
A7CR4	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A7CR5	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A7CR6	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A7CR7	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A7CR8	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A7CR9	1901-0059	SEMICON DEVICE:DIODE 1N629	
A7CR10	1901-0033	SEMICON DEVICE:DIODE SILICON 1N485 B	
A7CR11	1901-0033	SEMICON DEVICE:DIODE SILICON 1N485 B	
A7K1	0490-0125	RELAY:DPDT 1/4A 24VDC:COIL 24VDC	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index, General (cont'd)

Reference Designation	Stock No.	Description #	Note
A7K2	0490-0125	RELAY:DPDT 1/4A 24VDC:COIL 24VDC	
A7K3	0490-0125	RELAY:DPDT 1/4A 24VDC:COIL 24VDC	
A7K4	0490-0125	RELAY:DPDT 1/4A 24VDC:COIL 24VDC	
A7L1	9140-0137	COIL: FXD RF 1 MH	
A7L2	9140-0137	COIL: FXD RF 1 MH	
A7L3	9140-0137	COIL: FXD RF 1 MH	
A7Q1	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A7Q2	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A7Q3	1854-0022	TRANSISTOR:NPN SILICON	
A7Q4	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A7Q5	1854-0022	TRANSISTOR:NPN SILICON	
A7Q6	1854-0022	TRANSISTOR:NPN SILICON	
A7Q7	1854-0022	TRANSISTOR:NPN SILICON	
A7Q8	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A7Q9	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A7R1	0686-6225	R:FXD COMP 6200 OHM 5% 1/2W	
A7R2	0686-5115	R:FXD COMP 510 OHM 5% 1/2W	
A7R3	0686-2025	R:FXD COMP 2000 OHM 5% 1/2W	
A7R4	0686-5625	R:FXD COMP 5600 OHM 5% 1/2W	
A7R5	0686-1825	R:FXD COMP 1800 OHM 5% 1/2W	
A7R6	0683-5625	R:FXD COMP 5600 OHM 5% 1/4W	
A7R7	0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	
A7R8	0687-3931	R:FXD COMP 39K OHM 10% 1/2W	
A7R9	0690-1231	R:FXD COMP 12K OHM 10% 1W	
A7R10	0686-2725	R:FXD COMP 2700 OHM 5% 1/2W	
A7R11	0761-0074	R:FXD MET OX FLM 15K OHM 5% 1W	
A7R12	0758-0024	R:FXD MET FLM 100 OHM 5% 1/2W	
A7R13	0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	
A7R14	0758-0017	R:FXD MET FLM 1500 OHM 5% 1/2W	
A7R15	2100-0154	R:VAR COMP 1000 OHM 30% LIN 0.15W	
A7R16	0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	
A7R17	0758-0024	R:FXD MET FLM 100 OHM 5% 1/2W	
A7R18	0761-0074	R:FXD MET OX FLM 15K OHM 5% 1W	
A7R19	0758-0003	R:FXD MET FLM 1000 OHM 5% 1/2W	
A7R20	0758-0038	R:FXD MET FLM 9:1K OHM 5% 1/2W	
A7R21	0690-2721	R:FXD COMP 2700 OHM 10% 1W	
A7R22	2100-0095	R:VAR COMP 100K OHM 30% LIN 1/5W	
A7R23	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R24	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A7R25	0684-1001	R:FXD COMP 10 OHM 10% 1/4W	
A7TB1	00851-2013	BLANK PC BOARD:VERT. AMP.	
A7W1	00851-6037	CABLE ASSEMBLY:VERTICAL OUTPUT TO CRT 4-INCH CABLE TERM. W/FEMALE PIN	
A8	00851-6001	HV POWER SUPPLY ASSY	
A8C1	0170-0064	C:FXD MY 0.47UF 10% 100VDCW	
A8C2	0180-0104	C:FXD ELECT 200UF 15VDCW	
A8C3	0150-0036	C:FXD CER 470 PF 20% 6KV	
A8C3	5040-0400	SUPPORT:CAPACITOR	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index, General (cont'd)

Reference Designation	Stock No.	Description #	Note
A8C4	0150-0036	C:FXD CER 470 PF 20% 6KV	
	5040-0400	SUPPORT:CAPACITOR	
A8C5	0160-0151	C:FXD CER 4700PF +80%-20% 4000VDCW	
	5040-0401	SUPPORT:CAPACITOR	
A8C6	0160-2054	C:FXD MY 0.015 UF 10% 3000VDCW	
A8C7	0160-2054	C:FXD MY 0.015 UF 10% 3000VDCW	
A8C8	0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	
A8C9	0160-0151	C:FXD CER 4700PF +80%-20% 4000VDCW	
	5040-0401	SUPPORT:CAPACITOR	
A8C10	0150-0023	C:FXD CER 2000PF 20% 1000VDCW	
A8C11	0160-2054	C:FXD MY 0.015 UF 10% 3000VDCW	
A8CR1	1901-0142	RECTIFIER:SILICON	
A8CR2	1901-0142	RECTIFIER:SILICON	
A8CR3	1901-0142	RECTIFIER:SILICON	
A8CR4	1901-0142	RECTIFIER:SILICON	
A8L1	9140-0051	COIL:FXD 400 UH	
A8R1	0687-6801	R:FXD COMP 68 OHM 10% 1/2W	
A8R2	0687-1521	R:FXD COMP 1500 OHM 10% 1/2W	
A8R3	0687-2741	R:FXD COMP 270K OHM 10% 1/2W	
A8R4	0687-1231	R:FXD COMP 12K OHM 10% 1/2W	
A8R5	0690-3951	R:FXD COMP 3.9 MEGOHM 10% 1W	
A8R6	0690-3951	R:FXD COMP 3.9 MEGOHM 10% 1W	
A8R7	0690-3951	R:FXD COMP 3.9 MEGOHM 10% 1W	
A8R8	0690-3951	R:FXD COMP 3.9 MEGOHM 10% 1W	
A8R9	0690-3951	R:FXD COMP 3.9 MEGOHM 10% 1W	
A8R10	0687-1031	R:FXD COMP 10K OHM 10% 1/2W	
A8R11	0687-1051	R:FXD COMP 1 MEGOHM 10% 1/2W	
A8R12	0687-4731	R:FXD COMP 47K OHM 10% 1/2W	
A8R13	0690-1851	R:FXD COMP 1.8 MEGOHM 10% 1W	
A8R14	0690-1851	R:FXD COMP 1.8 MEGOHM 10% 1W	
A8R15	0690-1851	R:FXD COMP 1.8 MEGOHM 10% 1W	
A8R16	0690-1851	R:FXD COMP 1.8 MEGOHM 10% 1W	
A8R17	0690-8241	R:FXD COMP 820K OHM 10% 1W	
A8T1	9120-0092	TRANSFORMER:AUDIO STEP-UP	
A8TB1	00851-2006	BLANK PC BOARD:HV POWER SUPPLY	
A9	00851-6017	LOW VOLTAGE POWER SUPPLY ASSY.	
A9C1	0180-0089	C:FXD ELECT 10UF-10%+100% 150VDCW	
A9C2	0180-0138	C:FXD ELECT 100 UF -10+100% 40VDCW	
A9C3	0180-0049	C:FXD ELECT 20UF 50VDCW	
A9C4	0170-0042	C:FXD MY 0.33UF 5% 100VDCW	
A9C5	0170-0064	C:FXD MY 0.47UF 10% 100VDCW	
A9C6	0180-0097	C:FXD ELECT 47 UF 10% 35VDCW	
A9C7	0170-0064	C:FXD MY 0.47UF 10% 100VDCW	
A9C8	0160-0163	C:FXD MY 3300PF 10%	
A9C9	0180-0119	C:FXD ELECT 1UF -10+100% 25VDCW	
A9C10	0180-0097	C:FXD ELECT 47UF 10% 35VDCW	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index, General (cont'd)

Reference Designation	Stock No.	Description #	Note
A9CR1	1901-0029	SEMICON DEVICE:DIODE SI 600V	
A9CR2	1902-0241	SEMICON DEVICE:DIODE SILICON 100V 5%	
A9CR3	1901-0045	SEMICON DEVICE:DIODE SILICON	
A9CR4	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR5	1901-0045	SEMICON DEVICE:DIODE SILICON	
A9CR6	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR7	1902-0025	SEMICON DEVICE:DIODE SILICON	
A9CR8	1902-0017	SEMICON DEVICE:DIODE SI	
A9CR9	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR10	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR11	1902-0017	SEMICON DEVICE:DIODE SI	
A9CR12	1901-0049	SEMICON DEVICE:DIODE SILICON	
A9CR13	1901-0049	SEMICON DEVICE:DIODE SILICON	
A9CR14	1901-0049	SEMICON DEVICE:DIODE SILICON	
A9CR15	1901-0049	SEMICON DEVICE:DIODE SILICON	
A9CR16	1902-0017	SEMICON DEVICE:DIODE SI	
A9CR17	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR18	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR19	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9CR20	1901-0025	SEMICON DEVICE:DIODE JUNCTION	
A9Q1	1850-0040	TRANSISTOR:GERMANIUM 2N383 PNP	
A9Q2	1850-0065	TRANSISTOR:GERMANIUM 2N1370	
A9Q3	1854-0003	TRANSISTOR:NPN SILICON	
A9Q4	1850-0040	TRANSISTOR:GERMANIUM 2N383 PNP	
A9Q5	1854-0003	TRANSISTOR:NPN SILICON	
A9Q6	1854-0003	TRANSISTOR:NPN SILICON	
A9R1	0758-0012	R:FXD MET FLM 12K OHM 5% 1/2W	
A9R2	0757-0817	R:FXD MET FLM 750 OHM 1% 1/2W	
A9R3	0687-1231	R:FXD COMP 12K OHM 10% 1/2W	
A9R4	0699-0005	R:FXD COMP 2.7 OHM 10% 1W	
A9R5	0761-0016	R:FXD MET FLM 7500 OHM 5% 1W	
A9R6	0687-2211	R:FXD COMP 220 OHM 10% 1/2W	
A9R7	0687-1011	R:FXD COMP 100 OHM 10% 1/2W	
A9R8	0687-5611	R:FXD COMP 560 OHM 10% 1/2W	
A9R9	0687-4721	R:FXD COMP 4700 OHM 10% 1/2W	
A9R10	0687-3311	R:FXD COMP 330 OHM 10% 1/2W	
A9R11	0687-3321	R:FXD COMP 3300 OHM 10% 1/2W	
A9R12	0687-1021	R:FXD COMP 1000 OHM 10% 1/2W	
A9R13	0812-0027	R:FXD WW 3100 OHM 5% 3W	
A9R14	2100-0154	R:VAR COMP 1000 OHM 30% LIN 0.15W	
A9R15	0812-0027	R:FXD WW 3100 OHM 5% 3W	
A9R16	0687-3321	R:FXD COMP 3300 OHM 10% 1/2W	
A9R17	0687-6801	R:FXD COMP 68 OHM 10% 1/2W	
A9R18	0687-6801	R:FXD COMP 68 OHM 10% 1/2W	
A9R19	0687-1521	R:FXD COMP 1500 OHM 10% 1/2W	
A9R20	0687-3921	R:FXD COMP 3900 OHM 10% 1/2W	
A9R21	0811-0040	R:FXD WW 1 OHM 1% 5W	
A9R22	0687-5611	R:FXD COMP 560 OHM 10% 1/2W	
A9R23	0686-1225	R:FXD COMP 1200 OHM 5% 1/2W	
A9R24	0686-4725	R:FXD COMP 4700 OHM 5% 1/2W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index, General (cont'd)

Reference Designation	ℌ Stock No.	Description #	Note
A9R25	0687-8221	R:FXD COMP 6200 OHM 10% 1/2W	
A9R26	0687-5621	R:FXD COMP 5600 OHM 10% 1/2W	
A9R27	0687-8221	R:FXD COMP 6200 OHM 10% 1/2W	
A9R28	0758-0047	R:FXD MET FLM 7500 OHM 5% 1/2W	
A9R29	2100-0154	R:VAR COMP 1000 OHM 30% LIN 0.15W	
A9R30	0758-0047	R:FXD MET FLM 7500 OHM 5% 1/2W	
A9TB1	00851-2004	BLANK PC BOARD LOW VOLT POWER SUPPLY	
A10	00851-6039	SWITCH ASSY: SWEEP TIME	
	5040-0218	COUPLING:MECHANICAL P/O SWEEP TIME SWITCH	
A10C1	0170-0038	C:FXD MY 0.22UF 10% 200VDCW	
A10C2	0170-0051	C:FXD MY 0.635UF 5% 100VDCW	
A10C3	0180-0101	C:FXD ELECT TA 1.8UF 10% 35VDCW	
A10C4	0180-0116	C:FXD ELECT TA 6.8UF 10% 35VDCW	
A10C5	0180-0233	C:FXD TA ELECT. 20UF +20-15% 60VDCW	
A10C6	0180-0235	C:FXD TA ELECT. 56UF 20% 75VDCW	
A10C7	0170-0042	C:FXD MY 0.33UF 5% 100VDCW	
A10C8	0180-0230	C:FXD TA ELECT. 1UF 20% 50VDCW	
A10C9	0180-0231	C:FXD TA ELECT. 3.5UF +20-15% 75VDCW	
A10C10	0180-0232	C:FXD TA ELECT. 10UF 20% 100VDCW	
A10C11	0180-0234	C:FXD TA ELECT. 33UF 20% 75VDCW	
A10C12	0180-0113	C:FXD ELECT TA 100UF +20-15% 30VDCW	
A10R1	2100-0107	R:VAR COMP 50K OHM 30% 1/3W, VERNIER	
	0370-0114	KNOB:VERNIER FOR SWEEP TIME SWITCH	
A10R2	0757-0831	R:FXD MET FLM 4.32K OHM 1% 1/2W	
A10S1	3100-1500	SWITCH:ROTARY	
	0370-0113	KNOB, SWEEP TIME	
	3130-0041	SWITCH SHIELD	
A11	00851-6006	SWITCH ASSY.:VERT. DISPLAY	
A11C1	0160-0134	C:FXD MICA 220PF 5% 300VDCW	
A11C2	0160-0178	C:FXD MICA 27PF 5% 300VDCW	
A11C3	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A11C4	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A11C5	0150-0093	C:FXD CER 0.01 UF +80-20% 100VDCW	
A11CR1	1901-0047	SEMICON DEVICE:DIODE JUNCTION	
A11CR2	1901-0047	SEMICON DEVICE:DIODE JUNCTION	
A11CR3	1901-0047	SEMICON DEVICE:DIODE JUNCTION	
A11CR4	1901-0047	SEMICON DEVICE:DIODE JUNCTION	
A11L1	9140-0118	COIL:FXD 500 UH 5%	
A11Q1	1853-0003	TRANSISTOR:PNP SILICON F 50MC MIN	
A11Q2	1853-0003	TRANSISTOR:PNP SILICON F 50MC MIN	
A11R1	0683-1025	R:FXD COMP 1000 OHM 5% 1/4W	
A11R2	2100-0958	R:VAR COMP 10K OHM 20% 0.5W	
A11R3	0727-0405	R:FXD DEPE 57.46K OHM 1/2% 1/2W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designators and General

A11R4		NOT ASSIGNED
A11R5	07[illegible]	RIFXD DEPC 18K OHM 1% 1/[illegible]#
A11R6	0757-[illegible]	RIFXD MET FLM 32.4K OHM 1% 1/4#
A11R7	0757-[illegible]	RIFXD MET FLM 191K OHM 1% 1/4#
A11R8	0757-0885	RIFXD MET FLM 15.4K OHM 1% 1/4#
A11R9	0757-0889	RIFXD MET FLM 143K OHM 1% 1/4#
A11R10	0683-2025	RIFXD COMP 2000 OHM 5% 1/4#
A11R11	0683-3625	RIFXD COMP 3600 OHM 5% 1/4#
A11R12	0727-0123	RIFXD DEPC 2900 OHM 1% 1/2#
A11R13	2100-0957	RIVAR COMP 5K OHM 20% LIN 1/20#
A11R14	2100-0957	RIVAR COMP 5000 OHM 20% LIN 1/20#
A11R15	0727-0403	RIFXD DEPC 52.3K OHM 1/2% 1/2#
A11R16	0727-0126	RIFXD DEPC 3.206K OHM 1% 1/2#
A11R17	0727-0178	RIFXD DEPC 24.7K OHM 1% 1/2#
A11R18	0727-0101	RIFXD DEPC 1.03K OHM 1% 1/2#
A11R19	0727-0398	RIFXD DEPC 3.79K OHM 1/2% 1/2#
A11R20	2100-0956	RIVAR COMP 500 OHM 20% LIN 1/20#
A11S1	3100-0815	ROTARY SWITCH:2-SECTION 3-POSITION
	0370-0112	KNOB:VERTICAL DISPLAY
A11W1	00851-6033	CABLE ASSY. 17-IN COAX:VERT IN (C) TO A11S1
	00851-0017	COVER:INPUT BP FILTER,A12
A12	00851-6035	PC BOARD ASSY:INPUT BANDPASS FILTER
A12C1	0130-0017	CTVAR CER 8-50 PF N750
A12C2	0140-0194	CIFXD MICA 110 PF 5% 300VDC#
A12C3	0130-0017	CTVAR CER 8-50 PF N750
A12C4	0160-0178	CIFXD MICA 27 PF 5%
A12C5	0140-0197	CIFXD MICA 180 PF 5%
A12C6	0140-0204	CIFXD MICA 47 PF 5% NPO 500VDC# FACTORY SELECTED PART:TYPICAL VALUE GIVEN
A12J1	1250-0212	CONNECTOR:JACK CHASSIS BNC
A12J2	1250-0149	CONNECTOR:RF JACK CHASSIS RIGHT ANGLE
A12L1	00851-8001	COIL:RF FXD 0.3UH
A12L2	00851-8002	COIL:RF VAR 0.3UH MAX
A12TB1	00851-2016	BOARD:INPUT B.P. FILTER
C1	0150-0119	CIFXD CER 2X(0.01 UF) 20% 250VDC#
C2		NOT ASSIGNED
C3	0180-0042	CIFXD ELECT 120UF 350VDC#
	1520-0001	PLATE:MOUNTING ELECTROLYTIC CAPACITOR
C4	0180-0047	CIFXD ELEC[illegible] 500UF 75VDC#
	1520-0001	PLATE:MOUNTING ELECTROLYTIC CAPACITOR
C5	0180-0047	CIFXD ELECT 500UF 75VDC#
	1520-0001	PLATE:MOUNTING ELECTROLYTIC CAPACITOR
C6	0150-0121	CIFXD CER [illegible] UF +80%-20% 50VDC#
C7	0180-0059	CIFXD ELEC[illegible] 10 UF +[illegible]10% 25VDC#
C8	0180-0098	CIFXD ELECT 100 UF 20% 20VDC#

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index, General (cont'd)

Reference Designation	℗ Stock No.	Description #	Note
DS1	2140-0018	LAMP:GLOW 1/10W	
	5040-0234	LAMPHOLDER	
	5040-0235	BASE:LAMPHOLDER	
F1	2110-0016	FUSE:CARTRIDGE 0.6 AMP SLO-BLO 115V OPERATION	
F1	2110-0044	FUSE:CARTRIDGE 0.3 AMP SLO-BLO 230V OPERATION	
J1	-	I.F. INPUT, PART OF CABLE W1	
J2	1250-0171	CONNECTOR:BNC JACK SWEEP INPUT	
J3	1250-0171	CONNECTOR:BNC JACK BLANKING INPUT	
J4	1251-0148	CONNECTOR:POWER 3 PIN MALE LINE INPUT	
J5	1250-0083	CONNECTOR:BNC	
		I.F. TEST POINT	
	1200-0081	BUSHING:INSULATOR NYLON	
	1250-0053	CAP:CONNECTOR BNC WITH CHAIN	
J6		SYNC INPUT, PART OF CABLE W2	
J7		SWEEP OUTPUT, PART OF CABLE W3	
J8	1250-0171	CONNECTOR:BNC JACK, HORIZ OUTPUT	
J9	1251-0143	CONNECTOR:FEMALE 14 CONTACTS, CONTROL	
J9	1250-0171	CONNECTOR:BNC JACK, VERT OUTPUT	
L1	9140-0082	COIL:FXD RF 15 UH	
L2	9140-0082	COIL:FXD RF 15 UH	
L3	5060-0409	COIL:ALIGNMENT IN CRT TRACE ALIGN CIRCUIT	
L4	9110-0042	CHOKE:FILTER 70 MH 1.0 AMP 1.5 OHM	
MP1	175A-83A	RETAINER:CRT. SHIELD	
MP2	00851-0006	BRACKET:POWER SUPPLY	
MP3	00851-0007	SHIELD:HIGH VOLTAGE	
MP4	00851-0008	COVER:SOCKET	
MP5	00851-0009	BRACKET:SWEEP AND HORIZ AMPL PCBD A6	
MP6	00851-6008	CRT. SHIELD ASSEMBLY	
MP7	0905-0050	GASKET:FELT BLACK 5/16 INCH THICK	
MP8	4320-0007	EXTRUSION:RUBBER	
MP9	5000-0408	COIL BRACKET	
Q1	1850-0090	TRANSISTOR:GERMANIUM 2N1183B PNP	
	1200-0092	BUSHING:TRANSISTOR	
	1200-0076	INSULATOR:TRANISTOR	
Q2	1850-0090	TRANSISTOR:GERMANIUM 2N1183B PNP	
	1200-0092	BUSHING:TRANSISTOR	
	1200-0076	INSULATOR:TRANSISTOR	
Q3	1850-0098	TRANSISTOR:GERMANIUM PNP SELECTED	
	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
Q4	1850-0064	TRANSISTOR:GERMANIUM 2N1183 PNP	
	1200-0076	INSULATOR:TRANSISTOR	
	1200-0087	CLAMP:TRANSISTOR	
	1200-0081	BUSHING:INSULATOR NYLON	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index, General (cont'd)

Reference Designation	Stock No.	Description #	Note
Q5	1850-0064	TRANSISTOR:GERMANIUM 2N1183 PNP	
	1200-0076	INSULATOR:TRANSISTOR	
	1200-0087	CLAMP:TRANSISTOR	
Q6	1850-0098	TRANSISTOR:GERMANIUM PNP SELECTED	
	1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	
R1	2100-0893	R:VAR 2K(FRONT)750K(REAR)OHM LIN 1/2W	
	0370-0127	KNOB:INTENSITY	
	5040-0421	INSULATOR:POTENTIOMETER	
R2	2100-0027	R:VAR COMP 10K OHM 10% LIN 2W	
		INT LEVEL ADJ	
R3	2100-0189	R:VAR COMP 1 MEGOHM 30% LIN 1/4W	
		ASTIG. ADJ.	
R4	2100-0218	R:VAR COMP 1.2 MEGOHM 20% LIN 2W	
		FOCUS	
	0370-0026	KNOB,	
	5040-0418	INSULATOR:POTENTIOMETER	
R5	2100-0150	R:VAR 2-SECT 10K OHM 20% LIN 1/4W	
		TRACE ALIGN ADJ.	
R6	0758-0005	R:FXD DEPC. 4700 OHM 5% 1/2W	
R7	2100-0893	R:VAR 2K(FRONT)750K(REAR)OHM LIN 2W	
	0370-0120	KNOB:BASE LINE CLIPPER	
R8	2100-0036	R:VAR COMP 1000 OHM LIN	
		VERTICAL POSITION	
R9	2100-0067	R:VAR COMP 2500 OHM 10% LIN 1/2W	
		HORIZONTAL POSITION	
R10	2100-0019	R:VAR COMP 500 OHM 10% LIN 1/2W	
	0370-0026	KNOB:BLACK 0.750 DIA ,I.F. VERNIER	
R11	0727-0004	R:FXD DEPC 5 OHM 1% 1/2W	
R12	0727-0004	R:FXD DEPC 5 OHM 1% 1/2W	
S1	3101-0035	SWITCH:SLIDE DPDT	
		115V/230V	
S2	00851-6040	SWITCH ASSY: SYNC	
	0370-0112	KNOB:	
		SYNC	
S3	3101-0052	SWITCH:PUSHBUTTON SPST, NORMALLY OPEN	
		SINGLE SWEEP	
T1	9100-0274	TRANSFORMER:POWER	
		LINE	
V1	5083-0624	ELECTRON TUBE:CATHODE-RAY P-2 PHOSPHOR	
		NOT USED WHEN OPTION 07, OR 31 SPECIFIED	
	00851-2026	FILTER:CRT LT. BLUE	
		USED WITH P-2 PHOSPHOR	
	120A-20	BEZEL:CRT.	
V1	5083-0634	ELECTRON TUBE:CATHODE-RAY P-7 PHOSPHOR	
		OPTION 07	
	120A-83A	LIGHT FILTER:AMBER	
		FOR CRT V1	
V1	5083-0654	ELECTRON TUBE:CATHODE-RAY P-31 PHOSPHOR	
		OPTION 31	
	120A-83G	LIGHT FILTER:GREEN	
		FOR CRT V1	
W1	00851-6027	CABLE ASSY., IF INPUT	
		13-IN COAX W/BNC FEMALE J1 BNC MALE P1	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index, General (cont'd)

Reference Designation	Stock No.	Description #	Note
W2	00851-6016	CABLE ASSY.:SYNC INPUT 23-INCH COAX W/BNC FEMALEJACK J6	
W3	00851-6015	CABLE ASSY.:SWEEP OUTPUT 24-IN COAX W/BNC FEMALE J7	
W4	00140-61606	CABLE:HIGH VOLTAGE, INCLUDES 270K RES	
XF1	1400-0084	FUSEHOLDER EXTRACTOR POST TYPE	
XV1	1200-0037	SOCKET:CRT TUBE	
	1200-0085	COVER PLATE:CRT SOCKET 14-CONTACT	
	1200-0050	PIN:CRT SOCKET	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index, Assembly A2

Reference Designation	Stock No.	Description #	Note
	00851-6003	RF CIRCUIT ASSEMBLY	
		PREFIX DESIGNATIONS IN THIS TABLE WITH A2	
A1	00851-6025	INPUT SWITCHING CIRCUIT ASSY	
	00851-0013	COVER:RF CKT ASSY A2 HOUSING	
A1C1	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A1C2	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A1K1	0490-0125	RELAY:DPDT 1/4A 24VDC:COIL 24VDC	
A1K2	0490-0125	RELAY:DPDT 1/4A 24VDC:COIL 24VDC	
A1L1	9140-0146	COIL:FXD RF 10.0 UH	
A1L2	9140-0146	COIL:FXD RF 10.0 UH	
A1TB1	00851-2014	BLANK PC BOARD:INPUT SWITCHING CIRCUIT	
A2	00851-6022	20MC AMPLIFIER ASSY	
A2C1	0150-0050	C:FXD CER 1000PF 600 VDCW	
A2C2	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A2C3	0150-0042	C:FXD TI 4.7 PF 5% 500 VDCW	
A2C4	0140-0225	C:FXD MICA 300PF 1% 300VDCW	
A2C5	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A2C6	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A2C7	0150-0050	C:FXD CER 1000PF 600 VDCW	
A2L1	9140-0235	COIL:RF TAPPED 0.95-1.8UH	
A2L2	9140-0232	COIL:RF TAPPED 0.254UH-0.50UH	
A2L3	9140-0146	COIL:FXD RF 10.0 UH	
A2Q1	1850-0153	TRANSISTOR:PNP SM1642	
A2R1	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A2R2	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A2R3	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A2R4	0683-2215	R:FXD COMP 220 OHM 5% 1/4W	
A2R5	0683-1815	R:FXD COMP 180 OHM 5% 1/4W	
A2TB1	00851-2007	BLANK PC BOARD:AMPLIFIER (20MC)	
A3	00851-6023	FIRST 1-10KC BANDPASS FILTER ASSY.	
A3C1	0140-0175	C:FXD MICA 39 PF 2% 300 VDCW	
A3C2	0121-0037	C:VAR CER 7-25PF	
A3C3	0140-0175	C:FXD MICA 39 PF 2% 300 VDCW	
A3C4	0121-0037	C:VAR CER 7-25PF	
A3C5	0121-0033	C:VAR AIR 1.4-7.3PF	
A3C6	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
A3C7	0150-0050	C:FXD CER 1000PF 600 VDCW	
A3C8	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A3C9	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A3C10	0150-0050	C:FXD CER 1000PF 600 VDCW	
A3C11	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A3C12	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A3K1	0490-0125	RELAY:DPDT 1/4A 24VDC:COIL 24VDC	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index, Assembly A2 (cont'd)

Reference Designation	Stock No.	Description #	Note
A3K2	0490-0125	RELAY:DPDT 1/4A 24VDC:COIL 24VDC	
A3L1	00851-8005	COIL:RF	
A3L2	00851-8004	COIL:RF	
A3L3	9140-0235	COIL:RF TAPPED 0.95-1.8UH	
A3L4	9140-0150	COIL:FXD RF 2.7 UH	
A3L5	9140-0146	COIL:FXD RF 10.0 UH	
A3L6	9140-0146	COIL:FXD RF 10.0 UH	
A3Q1	1850-0153	TRANSISTOR:PNP SM1642	
A3R1	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A3R2	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A3R3	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A3R4	0683-4305	R:FXD COMP 43 OHM 5% .25W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A3R5	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A3TB1	00851-2008	BLANK PC BOARD:FIRST, 1-10KC, BP FILTER	
A3Y1	0410-0091	CRYSTAL:QUARTZ 20MC A3Y1 AND A4Y1 (MATCHED PAIR)	
A4	00851-6024	SECOND 1-10 KC BANDPASS FILTER ASSY.	
A4C1	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A4C2	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A4C3	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A4C4	0150-0056	C:FXD CER 1000PF 600 VDCW	
A4C5	0121-0037	C:VAR CER 7-25PF	
A4C6	0140-0175	C:FXD MICA 39 PF 2% 300 VDCW	
A4C7	0130-0017	C:VAR CER 8-50 PF N750	
A4C8	0121-0033	C:VAR AIR 1.4-7.3PF	
A4C9	0121-0037	C:VAR CER 7-25PF	
A4C10	0140-0175	C:FXD MICA 39 PF 2% 300 VDCW	
A4C11	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A4C12	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A4K1	0490-0125	RELAY:DPDT 1/4A 24VDC:COIL 24VDC	
A4K2	0490-0125	RELAY:DPDT 1/4A 24VDC:COIL 24VDC	
A4L1	00851-8006	COIL:RF	
A4L2	00851-8004	COIL:RF	
A4L3	9140-0146	COIL:FXD RF 10.0 UH	
A4L4	9140-0146	COIL:FXD RF 10.0 UH	
A4L5	9140-0146	COIL:FXD RF 10.0 UH	
A4Q1	1850-0153	TRANSISTOR:PNP SM1642	
A4R1	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	
A4R2	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A4R3	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A4R4	0683-3315	R:FXD COMP 330 OHM 5% 1/4W	
A4R5	0683-1015	R:FXD COMP 100 OHM 5% 1/4W	
A4TB1	00851-2009	BLANK PC BOARD:SECOND 1-10KC BP FILTER	
A4Y1	0410-0091	CRYSTAL:QUARTZ 20MC	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index, Assembly A2 (cont'd)

Reference Designation	Stock No.	Description #	Note
		A3Y1 AND A4Y1 (MATCHED PAIR)	
A5	00851-6026	OUTPUT SWITCHING CIRCUIT ASSY.	
A5C1	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A5C2	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A5K1	0490-0125	RELAY:DPDT 1/4A 24VDC:COIL 24VDC	
A5K2	0490-0125	RELAY:DPDT 1/4A 24VDC:COIL 24VDC	
A5L1	9140-0146	COIL:FXD RF 10.0 UH	
A5L2	9140-0146	COIL:FXD RF 10.0 UH	
A5TB1	00851-2015	BLANK PC BOARD-OUTPUT SWITCHING CIRCUIT	
A6	00851-6021	ASSY.:CURRENT-CONTROLLED ATTEN.	
A6C1	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
A6C2	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A6C3	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
A6C4	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A6C5	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
A6C6	0140-0192	C:FXD MICA 68PF 5% 300VDCW	
A6C7	0140-0192	C:FXD MICA 68PF 5% 300VDCW	
A6C8	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
A6C9	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
A6C10	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A6C11	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
A6C12	0150-0050	C:FXD CER 1000PF 600 VDCW	
A6C13	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A6C14	0140-0176	C:FXD MICA 100 PF 2% 300 VDCW	
A6CR1	1901-0162	SEMICON DEVICE:DIODE SOLD IN SET OF 6	
A6CR2	1901-0162	SEMICON DEVICE:DIODE SOLD IN SET OF 6	
A6CR3	1901-0162	SEMICON DEVICE:DIODE SOLD IN SET OF 6	
A6CR4	1901-0162	SEMICON DEVICE:DIODE SOLD IN SET OF 6	
A6CR5	1901-0162	SEMICON DEVICE:DIODE SOLD IN SET OF 6	
A6CR6	1901-0162	SEMICON DEVICE:DIODE SOLD IN SET OF 6	
A6L1	00851-8009	COIL:RF	
A6L2	9140-0149	COIL:FXD RF 1.86 UH	
A6L3	9140-0146	COIL:FXD RF 10.0 UH	
A6L4	9140-0152	COIL:FXD RF 41.06 UH	
A6L5	9140-0149	COIL:FXD RF 1.86 UH	
A6L6	9140-0146	COIL:FXD RF 10.0 UH	
A6L7	9140-0149	COIL:FXD RF 1.86 UH	
A6L8	9140-0149	COIL:FXD RF 1.86 UH	
A6L9	9140-0149	COIL:FXD RF 1.86 UH	
A6L10	00851-8010	COIL:RF	
A6L11	9140-0235	COIL:RF TAPPED 0.95-1.8UH	
A6L12	9140-0159	COIL:FXD 0.47UH 20%	
A6Q1	1850-0153	TRANSISTOR:PNP SM1642	
A6R1	0683-2725	R:FXD COMP 2700 OHM 5% 1/4W	

= See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index, Assembly A2 (cont'd)

Reference Designation	Stock No.	Description #	Note
A6R2	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A6R3	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A6RT1	0852-0021	R:TEMPERATURE COMPENSATING 100 OHM 5% 25C	
A6TB1	00851-2010	BOARD:CURRENT-CONTROLLED ATTEN	
A7	00851-6020	ASSY: 20 MC I.F. AMPLIFIER	
A7C1	0150-0050	C:FXD CER 1000PF 600 VDCW	
A7C2	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A7C3	0140-0176	C:FXD MICA 100 PF 2% 300 VDCW	
A7C4	0150-0050	C:FXD CER 1000PF 600 VDCW	
A7C5	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A7C6	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A7C7	0140-0190	C:FXD MICA 39 PF 5% 300 VDCW	
A7C8	0150-0050	C:FXD CER 1000PF 600 VDCW	
A7C9	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A7C10	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A7C11	0140-0215	C:FXD MICA 80PF 2% 300VDCW	
A7C12	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A7C13	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A7C14	0150-0093	C:FXD CER 0.01UF +80-20 100VDCW	
A7CR1	1910-0011	SEMICON DEVICE:DIODE GERMANIUM	
A7CR2	1910-0011	SEMICON DEVICE:DIODE GERMANIUM	
A7CR3	1910-0011	SEMICON DEVICE:DIODE GERMANIUM	
A7CR4	1910-0011	SEMICON DEVICE:DIODE GERMANIUM	
A7L1	9140-0159	COIL:FXD 0.47UH 20%	
A7L2	9140-0158	COIL:FXD 1.0UH 10%	
A7Q1	1850-0153	TRANSISTOR:PNP SM1642	
A7Q2	1850-0153	TRANSISTOR:PNP SM1642	
A7Q3	1850-0153	TRANSISTOR:PNP SM1642	
A7Q4	1853-0003	TRANSISTOR:PNP SILICON F 50MC MIN	
A7Q5	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A7R1	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A7R2	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A7R3	0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	
A7R4	0683-5105	R:FXD COMP 51 OHM 5% 1/4W FACTORY SELECTED PART:TYPICAL VALUE GIVEN	
A7R5	0683-6805	R:FXD COMP 68 OHM 5% 1/4W	
A7R6	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A7R7	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A7R8	0683-1225	R:FXD COMP 1200 OHM 5% 1/4W	
A7R9		NOT ASSIGNED	
A7R10	0683-6805	R:FXD COMP 68 OHM 5% 1/4W	
A7R11	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A7R12	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A7R13	0683-2705	R:FXD COMP 27 OHM 5% 1/4W	
A7R14	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A7R15	0683-6805	R:FXD COMP 68 OHM 5% 1/4W	
A7R16	0683-2235	R:FXD COMP 22K OHM 5% 1/4W	

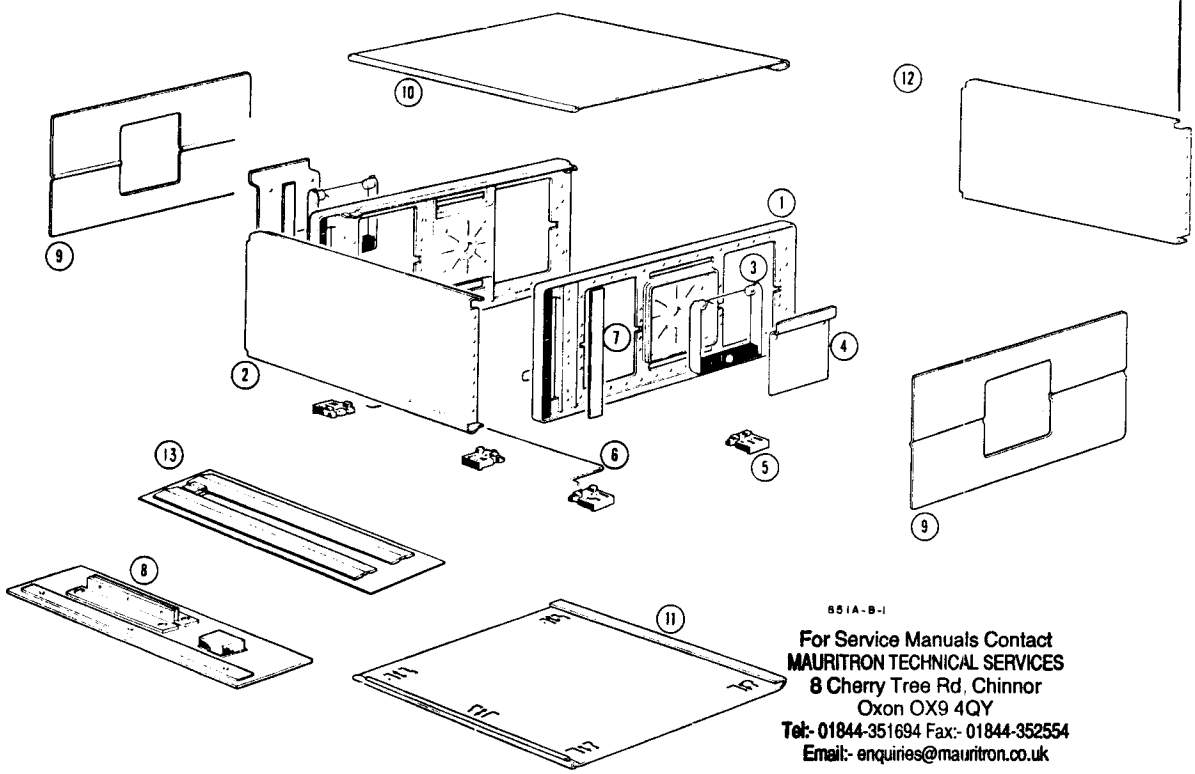
See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index, Assembly A2 (cont'd)

Reference Designation	ℌ Stock No.	Description #	Note
A7R17	0683-1245	R:FXD COMP 120K OHM 5% 1/4W	
A7R18	0684-1021	R:FXD COMP 1000 OHM 10% 1/4W	
A7R19	0683-1535	R:FXD COMP 15K OHM 5% 1/4W	
A7RT1	0852-0020	R:TEMPERATURE COMPENSATING 150 OHM 5% 25C	
A7T1	9120-0090	TRANSFORMER:INTERMEDIATE FREQUENCY	
A7TB1	00851-2011	BLANK PC BOARD:IF 20MC	
C1	0150-0119	C:FXD CER 2X(0.01 UF) 20% 250VDCW	
C2	0150-0022	C:FXD FI 3.3PF 10% 500VDCW	
C3	0150-0019	C:FXD CER 1000PF 20% 500 VDCW	
C4	0150-0019	C:FXD CER 1000PF 20% 500 VDCW	
C5	0180-0076	C:FXD ELECT 20UF 25VDCW	
C6	0150-0019	C:FXD CER 1000 PF 20% 500VDCW FEED-THRU	
J1	1250-0083	CONNECTOR: ENC INPUT TO A2	
L1	9140-0051	COIL:FXD 400 UH	
R1	0684-1021	R:FXD COMP 1000 OHM 10% 1/4W	
W1	00851-6029	CABLE ASSY. 7-INCH COAX W/MALE RF CONN	
W2	00851-6030	CABLE ASSY. 9-INCH COAX W/MALE RF CONN	
W3	00851-6029	CABLE ASSY. 7-INCH COAX W/MALE RF CONN	
W4	00851-6029	CABLE ASSY. 7-INCH COAX W/MALE RF CONN	
W5	00851-6031	CABLE ASSY. 22-INCH COAX:ATTEN-VERT DISPLAY SWITCH	
W6	00851-6034	CABLE:5-INCH COAX VIDEO OUT TO VERT AM	
W7	00851-6033	CABLE:16-1/2 INCH COAX	
W1P1	1250-0229	CONNECTOR:RF CABLE PLUG SUB-MINIATURE	
W2P2	1250-0229	CONNECTOR:RF CABLE PLUG SUB-MINIATURE	
W3P3	1250-0229	CONNECTOR:RF CABLE PLUG SUB-MINIATURE	
W4P4	1250-0229	CONNECTOR:RF CABLE PLUG SUB-MINIATURE	
Z1	00851-8003	FILTER:LOW-PASS	
Z2	00851-8003	FILTER:LOW-PASS	
Z3	00851-8003	FILTER:LOW-PASS	
Z4	00851-8003	FILTER:LOW-PASS	
Z5	00851-8003	FILTER:LOW-PASS	
		MISCELLANEOUS	
	0340-0095	TERMINAL:FEEDTHRU TEFLON INSULATED OUTPUT: 20 MC I.F. TO VERT AMPL	

See list of abbreviations in introduction to this section

Cabinet Parts, Model 851B



Reference Designation	Stock No.	Description #	TQ
1.	5060-0734	FRAME ASSEMBLY	2
	0590-0053	#6-32 NUT-CAPTIVE, J TYPE FOR 0.125"	8
2.	00851-0002	FRONT PANEL	1
	2530-0011	#8-32 X 3/8" FH SLOT DR W/INTERNAL LOCKWASHER	4
3.	5060-0763	HANDLE ASSEMBLY:SIDE	2
4.	5060-0765	RETAINER:HANDLE	2
	2550-0013	#8-32 X 5/16" BH, PHILLIPS DRIVE	4
5.	5060-0767	FOOT ASSEMBLY	5
6.	1490-0030	STAND:TILT	2
7.	5000-0052	TRIM:ALUMINUM	2
8.	5060-0776	KIT:RACK MOUNTING	1
9.	5000-0742	SIDE COVER:UNPERFORATED	2
	2370-0020	#6-32 X 3/16", 100°FH, PHILLIPS DRIVE	8
10.	5060-0740	COVER ASSEMBLY:TOP,UNPERFORATED	1
	2370-0021	#6-32 X 7/16"FH, PHILLIPS DRIVE	4
11.	5060-0752	COVER ASSEMBLY:BOTTOM,UNPERFORATED	1
	2370-0021	#6-32 X 7/16"FH,PHILLIPS DRIVE	4
12.	00851-0001	REAR PANEL	1
	2515-0017	#8-32 X 1/4",RECESSED PHILLIPS PANHEAD W/INTERNAL LOCKWASHER	4
13.	5060-0216	BRACKET,JOINING KIT	1
	2370-0013	#6-32 X 3/8", 100°FH PHILLIPS DRIVE	12

≠ See list of abbreviations in introduction to this section

Table 6-3. Replaceable Parts (cont'd)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
0683-4735	R:FXD COMP 47K OHM 5% 1/4W	01121	CB 4735	1
0683-5105	R:FXD COMP 51 OHM 5% 1/4W	01121	CB 5105	1
0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125	2
0683-5625	R:FXD COMP 5600 OHM 5% 1/4W	01121	CB 5625	1
0683-6805	R:FXD COMP 68 OHM 5% 1/4W	01121	CB 6805	3
0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825	9
0683-9115	R:FXD COMP 910 OHM 5% 1/4W	01121	CB 9115	1
0684-1001	R:FXD COMP 10 OHM 10% 1/4W	01121	CB 1001	1
0684-1011	R:FXD COMP 100 OHM 10% 1/4W	01121	CB 1011	1
0684-1021	R:FXD COMP 1000 OHM 10% 1/4W	01121	CB 1021	2
0684-1031	R:FXD COMP 10K OHM 10% 1/4W	01121	CB 1031	1
0684-4711	R:FXD COMP 470 OHM 10% 1/4W	01121	CB 4711	1
0686-1225	R:FXD COMP 1200 OHM 5% 1/2W	01121	EB 1225	1
0686-1825	R:FXD COMP 1800 OHM 5% 1/2W	01121	EB 1825	1
0686-2025	R:FXD COMP 2000 OHM 5% 1/2W	01121	EB 2025	1
0686-2725	R:FXD COMP 2700 OHM 5% 1/2W	01121	EB 2725	1
0686-4725	R:FXD COMP 4700 OHM 5% 1/2W	01121	EB 4725	1
0686-5115	R:FXD COMP 510 OHM 5% 1/2W	01121	EB 5115	1
0686-5625	R:FXD COMP 5600 OHM 5% 1/2W	01121	EB 5625	1
0686-6225	R:FXD COMP 6200 OHM 5% 1/2W	01121	EB 6225	1
0686-7525	R:FXD COMP 7500 OHM 5% 1/2W	01121	EB 7525	1
0687-1011	R:FXD COMP 100 OHM 10% 1/2W	01121	EB 1011	1
0687-1021	R:FXD COMP 1000 OHM 10% 1/2W	01121	EB 1021	1
0687-1031	R:FXD COMP 10K OHM 10% 1/2W	01121	EB 1031	1
0687-1041	R:FXD COMP 100K OHM 10% 1/2W	01121	EB 1041	1
0687-1051	R:FXD COMP 1 MEGOHM 10% 1/2W	01121	EB 1051	1
0687-1231	R:FXD COMP 12K OHM 10% 1/2W	01121	EB 1231	2
0687-1521	R:FXD COMP 1500 OHM 10% 1/2W	01121	EB 1521	2
0687-2211	R:FXD COMP 220 OHM 10% 1/2W	01121	EB 2211	1
0687-2741	R:FXD COMP 270K OHM 10% 1/2W	01121	EB 2741	1
0687-3311	R:FXD COMP 330 OHM 10% 1/2W	01121	EB 3311	1
0687-3321	R:FXD COMP 3300 OHM 10% 1/2W	01121	EB 3321	2
0687-3921	R:FXD COMP 3900 OHM 10% 1/2W	01121	EB 3921	1
0687-3931	R:FXD COMP 39K OHM 10% 1/2W	01121	EB 3931	1
0687-4721	R:FXD COMP 4700 OHM 10% 1/2W	01121	EB 4721	1
0687-4731	R:FXD COMP 47K OHM 10% 1/2W	01121	EB 4731	1
0687-5611	R:FXD COMP 560 OHM 10% 1/2W	01121	EB 5611	2
0687-5621	R:FXD COMP 5600 OHM 10% 1/2W	01121	EB 5621	1
0687-6801	R:FXD COMP 68 OHM 10% 1/2W	01121	EB 6801	3
0687-8221	R:FXD COMP 8200 OHM 10% 1/2W	01121	EB 8221	2
0690-1231	R:FXD COMP 12K OHM 10% 1W	01121	GB 1231	1
0690-1851	R:FXD COMP 1.8 MEGOHM 10% 1W	01121	GB 1851	4
0690-2721	R:FXD COMP 2700 OHM 10% 1W	01121	GB 2721	1
0690-3951	R:FXD COMP 3.9 MEGOHM 10% 1W	01121	GB 3951	5
0690-8241	R:FXD COMP 820K OHM 10% 1W	01121	GB 8241	1
0699-0005	R:FXD COMP 2.7 OHM 10% 1W	01121	GB 27G1	1
0727-0004	R:FXD DEPC 5 OHM 1% 1/2W	28480	0727-0004	2
0727-0005	R:FXD DEPC 5.77 OHM 1/2% 1/2W	28480	0727-0005	1
0727-0008	R:FXD DEPC 11.61 OHM 1/2% 1/2W	28480	0727-0008	1
0727-0010	R:FXD DEPC 17.61 OHM 1/2% 1/2W	28480	0727-0010	1

See list of abbreviations in introduction to this section

Table 6-3. Replaceable Parts (cont'd)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
0727-0017	R:FXD DEPC 37.35 OHM 1/2% 1/2W	28480	0727-0017	1
0727-0025	R:FXD DEPC 51.5 OHM 1% 1/2W	28480	0727-0025	2
0727-0033	R:FXD DEPC 61.11 OHM 1% 1/2W	28480	0727-0033	2
0727-0036	R:FXD DEPC 71.16 OHM 1% 1/2W	28480	0727-0036	1
0727-0042	R:FXD DEPC 96.25 OHM 1/2% 1/2W	28480	0727-0042	2
0727-0048	R:FXD DEPC 150 OHM 1% 1/2W	28480	0727-0048	2
0727-0062	R:FXD DEPC 247.5 OHM 1/2% 1/2W	28480	0727-0062	1
0727-0063	R:FXD DEPC 292.5 OHM 1% 1/2W	28480	0727-0063	2
0727-0074	R:FXD DEPC 436 OHM 1/2% 1/2W	28480	0727-0074	2
0727-0094	R:FXD DEPC 870 OHM 1/2% 1/2W	28480	0727-0094	2
0727-0101	R:FXD DEPC 1.03K OHM 1% 1/2W	28480	0727-0101	1
0727-0122	R:FXD DEPC 2.51K OHM 1% 1/2W	28480	0727-0122	1
0727-0123	R:FXD DEPC 2900 OHM 1% 1/2W	19701	DC1/2A	1
0727-0124	R:FXD DEPC 3000 OHM 1% 1/2W	19701	DC1/2CR2	1
0727-0126	R:FXD DEPC 3.266K OHM 1% 1/2W	19701	DC1/2A	1
0727-0136	R:FXD DEPC 5.03K OHM 1% 1/2W	28480	0727-0136	2
0727-0158	R:FXD DEPC 10.1K OHM 1% 1/2W	28480	0727-0158	2
0727-0163	R:FXD DEPC 11.68K OHM 1% 1/2W	28480	0727-0163	1
0727-0170	R:FXD DEPC 18K OHM 1% 1/2W	19701	DC1/2C	1
0727-0173	R:FXD DEPC 20K OHM 1% 1/2W	28480	0727-0173	1
0727-0178	R:FXD DEPC 24.7K OHM 1% 1/2W	19701	DC1/2A	1
0727-0189	R:FXD DEPC 41.7K OHM 1% 1/2W	28480	0727-0189	2
0727-0398	R:FXD DEPC 3.79K OHM 1/2% 1/2W	28480	0727-0398	1
0727-0403	R:FXD DEPC 52.3K OHM 1/2% 1/2W	19701	DC1/2A	1
0727-0405	R:FXD DEPC 57.46K OHM 1/2% 1/2W	19701	DC1/2A	1
0757-0817	R:FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817	1
0757-0831	R:FXD MET FLM 4.32K OHM 1% 1/2W	28480	0757-0831	1
0757-0885	R:FXD MET FLM 15.4K OHM 1% 1/4W	28480	0757-0885	1
0757-0887	R:FXD MET FLM 32.4K OHM 1% 1/4W	28480	0757-0887	1
0757-0889	R:FXD MET FLM 143K OHM 1% 1/4W	28480	0757-0889	1
0757-0890	R:FXD MET FLM 191K OHM 1% 1/4W	28480	0757-0890	1
0758-0002	R:FXD MET FLM 560 OHM 5% 1/2W	07115	C 20	1
0758-0003	R:FXD MET FLM 1000 OHM 5% 1/2W	28480	0758-0003	1
0758-0004	R:FXD MET FLM 2700 OHM 5% 1/2W	07115	C 20	1
0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	28480	0758-0005	4
0758-0012	R:FXD MET FLM 12K OHM 5% 1/2W	07115	C 20	2
0758-0017	R:FXD MET FLM 1500 OHM 5% 1/2W	07115	C 20	1
0758-0022	R:FXD MET FLM 82K OHM 5% 1/2W	28480	0758-0022	1
0758-0024	R:FXD MET FLM 100 OHM 5% 1/2W	07115	C 20	2
0758-0034	R:FXD MET FLM 2400 OHM 5% 1/2W	07115	C 20	2
0758-0038	R:FXD MET FLM 9100 OHM 5% 1/2W	07115	C 20	2
0758-0043	R:FXD MET FLM 1800 OHM 5% 1/2W	07115	C 20	1
0758-0044	R:FXD MET FLM 2200 OHM 5% 1/2W	07115	C 20	2
0758-0047	R:FXD MET FLM 7500 OHM 5% 1/2W	07115	C 20	2
0758-0051	R:FXD MET FLM 43K OHM 5% 1/2W	07115	C 20	1
0758-0057	R:FXD MET FLM 5600 OHM 5% 1/2W	07115	C 20	1
0761-0016	R:FXD MET FLM 7500 OHM 5% 1W	07115	C 32	1
0761-0074	R:FXD MET OX FLM 15K OHM 5% 1W	28480	0761-0074	2
0811-0040	R:FXD WW 1 OHM 1% 5W	91637	RS5	1
0812-0027	R:FXD WW 3100 OHM 5% 3W	35434	VTA 3	2

= See list of abbreviations in introduction to this section

Table 6-3. Replaceable Parts (cont'd)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
0852-0020	R:TEMPERATURE COMPENSATING 150 OHM 5% 25C	01295	TM1/8 150 OHM-5%	1
0852-0021	R:TEMPERATURE COMPENSATING 100 OHM 5% 25C	01295	TM 1/8 100 OHM-5%	2
0905-0050	GASKET:FELT BLACK 5/16 INCH THICK	85471	OBD#	1
1200-0037	SOCKET:CRT TUBE	72825	97094	1
1200-0043	INSULATOR:TRANSISTOR ANODIZED ALUMINUM	76530	294457	2
1200-0050	PIN:CRT SOCKET	28480	1200-0050	14
1200-0076	INSULATOR:TRANISTOR	02735	DF14AC	4
1200-0081	BUSHING:INSULATOR NYLON	26365	974SPECIAL	3
1200-0085	COVER PLATE:CRT SOCKET 14-CONTACT	72825	9109-1	1
1200-0087	CLAMP:TRANSISTOR	02735	DF-13-A	4
1200-0092	BUSHING:TRANSISTOR	02735	495334-1	8
1250-0053	CAP:CONNECTOR BNC WITH CHAIN	91737	CW123A/U	1
1250-0083	CONNECTOR:BNC	91737	UG-1094/U	2
1250-0149	CONNECTOR:RF JACK CHASSIS RIGHT ANGLE	91737	UG-1174/U	1
1250-0171	CONNECTOR:BNC JACK	91737	11246	4
1250-0212	CONNECTOR:JACK CHASSIS BNC	91737	11656	1
1250-0228	CONNECTOR:RF JACK CHASSIS	94735	RF 6650	4
1250-0229	CONNECTOR:RF CABLE PLUG SUB-MINIATURE	94735	RF 6621-27	4
1251-0148	CONNECTOR:POWER 3 PIN MALE	60427	H-10611G-3L	1
1400-0084	FUSEHOLDER EXTRACTOR POST TYPE	75915	342014	1
1520-0001	PLATE:MOUNTING ELECTROLYTIC CAPACITOR	28480	1520-0001	3
1850-0040	†TRANSISTOR:GERMANIUM 2N383 PNP	94154	2N383	2
1850-0062	TRANSISTOR:GERMANIUM ALLOY JUNCTION	28480	1850-0062	5
1850-0064	TRANSISTOR:GERMANIUM 2N1183 PNP	02735	2N1183	2
1850-0065	TRANSISTOR:GERMANIUM 2N1370	01295	2N1370	4
1850-0090	†TRANSISTOR:GERMANIUM 2N1183B PNP	86684	2N1183B	2
1850-0098	†TRANSISTOR:GERMANIUM PNP SELECTED	28480	1850-0098	2
1850-0153	†TRANSISTOR:PNP SM1642	28480	1850-0153	7
1851-0017	TRANSISTOR:2N1304	01295	2N1304	6
1853-0003	†TRANSISTOR:PNP SILICON F 50MC MIN	28480	1853-0003	3
1854-0003	†TRANSISTOR:NPN SILICON	28480	1854-0003	7
1854-0005	†TRANSISTOR:2N708 NPN SILICON	07263	2N708	6
1854-0022	†TRANSISTOR:NPN SILICON	28480	1854-0022	7
1854-0033	†TRANSISTOR:SILICON NPN 2N3391	03508	2N3391	1
1901-0025	SEMICON DEVICE:DIODE JUNCTION	28480	1901-0025	13
1901-0029	SEMICON DEVICE:DIODE SI 600V	28480	1901-0029	1
1901-0033	SEMICON DEVICE:DIODE SILICON 1N485 B	07910	1N485B	2
1901-0045	SEMICON DEVICE:DIODE SILICON	28480	1901-0045	2
1901-0047	SEMICON DEVICE:DIODE JUNCTION	28480	1901-0047	4
1901-0049	SEMICON DEVICE:DIODE SILICON	28480	1901-0049	4
1901-0059	SEMICON DEVICE:DIODE 1N629	03877	1N629	1
1901-0096	SEMICON DEVICE:DIODE SILICON	28480	1901-0096	4
1901-0142	RECTIFIER:SILICON	28480	1901-0142	4
1901-0162	SEMICON DEVICE:DIODE SOLD IN SET OF 6	28480	1901-0162	6
1902-0017	SEMICON DEVICE:DIODE SI	28480	1902-0017	4
1902-0025	SEMICON DEVICE:DIODE SILICON	28480	1902-0025	2
1902-0050	SEMICON DEVICE:DIODE SI JUNC 8.66V 5%	28480	1902-0050	1
1902-0241	SEMICON DEVICE:DIODE SILICON 100V 5%	28480	1902-0241	1
1910-0011	SEMICON DEVICE:DIODE GERMANIUM	28480	1910-0011	4
2100-0019	R:VAR COMP 500 OHM 10% LIN 1/2W	28480	2100-0019	1

See list of abbreviations in introduction to this section

Table 6-3. Replaceable Parts (cont'd)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
2100-0027	R:VAR COMP 10K OHM 10% LIN 2W	28480	2100-0027	1
2100-0036	R:VAR COMP 1000 OHM LIN	28480	2100-0036	1
2100-0067	R:VAR COMP 2500 OHM 10% LIN 1/2W	28480	2100-0067	1
2100-0092	R:VAR COMP 10K OHM 20% LIN 1/5W	28480	2100-0092	1
2100-0095	R:VAR COMP 100K OHM 30% LIN 1/5W	28480	2100-0095	1
2100-0107	R:VAR COMP 50K OHM 30% 1/3W VERNIER	28480	2100-0107	1
2100-0144	R:VAR COMP 250K OHM 30% LIN 2/5W	28480	2100-0144	1
2100-0150	R:VAR 2-SECT 10K OHM 20% LIN 1/4W	28480	2100-0150	1
2100-0154	R:VAR COMP 1000 OHM 30% LIN 0.15W	28480	2100-0154	3
2100-0189	R:VAR COMP 1 MEGOHM 30% LIN 1/4W	28480	2100-0189	1
2100-0218	R:VAR COMP 1.2 MEGOHM 20% LIN 2W	28480	2100-0218	1
2100-0893	R:VAR 2K(FRONT)750K(REAR)OHM LIN 1/2W	28480	2100-0893	2
2100-0910	R:VAR COMP 2X35K OHM LIN 20% 1/4W	71590	SERIES 5 TYPE 71-2	6
2100-0956	R:VAR COMP 500 OHM 20% LIN 1/20W	28480	2100-0956	1
2100-0957	R:VAR COMP 5K OHM 20% LIN 1/20W	28480	2100-0957	2
2100-0958	R:VAR COMP 10K OHM 20% 0.5W	28480	2100-0958	1
2110-0016	FUSE:CARTRIDGE 0.6 AMP SLO-BLO	75915	#313.600	1
2110-0044	FUSE:CARTRIDGE 0.3 AMP SLO-BLO	71400	TYPE MDL	1
2140-0018	LAMP:GLOW 1/10W	24455	NE 2E1	1
3100-0812	ROTARY SWITCH	28480	3100-0812	2
3100-0815	ROTARY SWITCH:2-SECTION 3-POSITION	28480	3100-0815	1
3100-1500	SWITCH:ROTARY	28480	3100-1500	1
3101-0033	SWITCH:SLIDE DPDT	42190	4633	1
3101-0052	SWITCH:PUSHBUTTON, NORMALLY OPEN	28480	3101-0052	1
3130-0041	SWITCH SHIELD	76854	3130-0041	1
4320-0007	EXTRUSION:RUBBER	28480	4320-0007	1
5000-0408	COIL:BRACKET	28480	5000-0408	1
5040-0218	COUPLING:MECHANICAL	28480	5040-0218	1
5040-0234	LAMPHOLDER	28480	5040-0234	1
5040-0235	BASE:LAMPHOLDER	28480	5040-0235	1
5040-0400	SUPPORT:CAPACITOR	28480	5040-0400	2
5040-0401	SUPPORT:CAPACITOR	28480	5040-0401	2
5040-0418	INSULATOR:POTENTIOMETER	28480	5040-0418	1
5040-0421	INSULATOR:POTENTIOMETER	28480	5040-0421	1
5060-0409	COIL:ALIGNMENT	28480	5060-0409	1
5083-0624	ELECTRON TUBE:CATHODE-RAY P-2 PHOSPHOR	28480	5083-0624	1
5083-0634	ELECTRON TUBE:CATHODE-RAY P-7 PHOSPHOR	28480	5083-0634	1
5083-0654	ELECTRON TUBE:CATHODE-RAY P-31 PHOSPHOR	28480	5083-0654	1
9100-0274	TRANSFORMER:POWER	28480	6-2463	1
9110-0042	CHOKE:FILTER 70 MH 1.0 AMP 1.5 OHM	28480	9110-0042	1
9120-0090	TRANSFORMER:INTERMEDIATE FREQUENCY	28480	9120-0090	1
9120-0092	TRANSFORMER:AUDIO	28480	9120-0092	1
9140-0051	COIL:FXD 400 UH	28480	9140:0051	2
9140-0082	COIL:FXD RF 15 UH	28480	9140-0082	2
9140-0118	COIL:FXD 500 UH 5%	99800	2500-14	1
9140-0137	COIL: FXD RF 1 MH	28480	9140-0137	3
9140-0146	COIL:FXD RF 10.0 UH	28480	9140:0146	12
9140-0149	COIL:FXD RF 1.86 UH	28480	9140:0149	5
9140-0150	COIL:FXD RF 2.7 UH	28480	9140:0150	1
9140-0152	COIL:FXD RF 41.06 UH	28480	9140:0152	1
9140-0158	COIL:FXD 1.0UH 10%	99800	1025-20	1
9140-0159	COIL:FXD 0.47UH 20%	99800	1025-SERIES	2

See list of abbreviations in introduction to this section

Table 6-3. Replaceable Parts (cont'd)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
9140-0232	COIL:RF TAPPED 0.254UH-0.50UH	28480	9140-0232	1
9140-0235	COIL:RF TAPPED 0.95-1.8UH	28480	9140-0235	3
08551-2083	BUSHING	28480	08551-2083	1
00140-61606	CABLE:HIGH VOLTAGE, INCLUDES 270K RES	28480	00140-61606	1
00851-0006	BRACKET:POWER SUPPLY	28480	00851-0006	1
00851-0007	SHIELD:HIGH VOLTAGE	28480	00851-0007	1
00851-0008	COVER:SOCKET	28480	00851-0008	1
00851-0009	BRACKET:SWEEP AND HORIZ AMPL PCBD A6	28480	00851-0009	1
00851-0013	COVER:RF CKT ASSY A2 HOUSING	28480	00851-0013	1
00851-0014	COVER:SWITCH IF GAIN	28480	00851-0014	2
00851-0015	PLATE, COVER IF GAIN	28480	00851-0015	2
00851-0016	BRACKET:IF GAIN (DB) SWITCH	28480	00851-0016	1
00851-0017	COVER:INPUT BP FILTER.A12	28480	00851-0017	1
00851-2004	BLANK PC BOARD LOW VOLT POWER SUPPLY	28480	00851-2004	1
00851-2005	BLANK PC BOARD, SWEEP & HORIZ AMPL	28480	00851-2005	1
00851-2006	BLANK PC BOARD:HV POWER SUPPLY	28480	00851-2006	1
00851-2007	BLANK PC BOARD:AMPLIFIER (20MC)	28480	00851-2007	1
00851-2008	BLANK PC BOARD:FIRST, 1-10KC, BP FILTER	28480	00851-2008	1
00851-2009	BLANK PC BOARD:SECOND 1-10KC BP FILTER	28480	00851-2009	1
00851-2010	BOARD:CURRENT-CONTROLLED ATTEN	28480	00851-2010	1
00851-2011	BLANK PC BOARD:IF 20MC	28480	00851-2011	1
00851-2013	BLANK PC BOARD:VERT. AMP.	28480	00851-2013	1
00851-2014	BLANK PC BOARD:INPUT SWITCHING CIRCUIT	28480	00851-2014	1
00851-2015	BLANK PC BOARD-OUTPUT SWITCHINGCIRCUIT	28480	00851-2015	1
00851-2016	BOARD:INPUT B.P. FILTER	28480	00851-2016	1
00851-2022	CAVITY:FILTER	28480	00851-2022	2
00851-2026	FILTER:CRT LT. BLUE	28480	00851-2026	1
00851-2027	KNOB:IF GAIN 0-70 DB	28480	00851-2027	1
00851-2028	KNOB:IF GAIN 0-10 DB	28480	00851-2028	1
00851-6001	HV POWER SUPPLY ASSY	28480	00851-6001	1
00851-6002	SWITCH ASSY:IF GAIN (DB)	28480	00851-6002	1
00851-6003	ASSY:RF CIRCUIT	28480	00851-6003	1
00851-6006	SWITCH ASSY.:VERT. DISPLAY	28480	00851-6006	1
00851-6007	SWITCH ASSY.:I.F. BANDWIDTH	28480	00851-6007	1
00851-6008	CRT. SHIELD ASSEMBLY	28480	00851-6008	1
00851-6013	CABLE ASSY:ATTEN OUTPUT	28480	00851-6013	1
00851-6014	CABLE ASSY:ATTEN INPUT	28480	00851-6014	1
00851-6015	CABLE ASSY.:SWEEP OUTPUT	28480	00851-6015	1
00851-6016	CABLE ASSY.:SYNC INPUT	28480	00851-6016	1
00851-6017	LOW VOLTAGE POWER SUPPLY ASSY.	28480	00851-6017	1
00851-6019	BOARD ASSY:VERT. AMPL. ASSY.	28480	00851-6019	1
00851-6020	ASSY: 20 MC I.F. AMPLIFIER	28480	00851-6020	1
00851-6021	ASSY.:CURRENT-CONTROLLED ATTEN.	28480	00851-6021	1
00851-6022	20MC AMPLIFIER ASSY	28480	00851-6022	1
00851-6023	FIRST 1-10KC BANDPASS FILTER ASSY.	28480	00851-6023	1
00851-6024	SECOND 1-10 KC BANDPASS FILTER ASSY.	28480	00851-6024	1
00851-6025	INPUT SWITCHING CIRCUIT ASSY	28480	00851-6025	1
00851-6026	OUTPUT SWITCHING CIRCUIT ASSY.	28480	00851-6026	1
00851-6027	CABLE ASSY., IF INPUT	28480	00851-6027	1
00851-6028	FILTER ASSY.:100KC BAND-PASS	28480	00851-6028	2

See list of abbreviations in introduction to this section

Table 6-3. Replaceable Parts (cont'd)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
00851-6029	CABLE ASSY.	28480	00851-6029	3
00851-6030	CABLE ASSY.	28480	00851-6030	1
00851-6031	CABLE ASSY.	28480	00851-6031	1
00851-6032	CABLE ASSY.	28480	00851-6032	1
00851-6033	CABLE ASSY.	28480	00851-6033	2
00851-6034	CABLE:5-INCH COAX VIDEO OUT TO VERT AMP	28480	00851-6034	1
00851-6035	PC BOARD ASSY:INPUT BANDPASS FILTER	28480	00851-6035	1
00851-6036	CABLE ASSY:HORIZ. OUTPUT TO CRT	28480	00851-6036	1
00851-6037	CABLE ASSEMBLY:VERTICAL OUTPUT TO CRT	28480	00851-6037	1
00851-6038	BOARD ASSY: SWEEP & HORIZ AMPL	28480	00851-6038	1
00851-6039	SWITCH ASSY: SWEEP TIME	28480	00851-6039	1
00851-6040	SWITCH ASSY: SYNC	28480	00851-6040	1
00851-8001	COIL:RF FXD 0.3UH	28480	00851-8001	1
00851-8002	COIL:RF VAR 0.3UH MAX	28480	00851-8002	1
00851-8003	FILTER:LOW-PASS	28480	00851-8003	5
00851-8004	COIL:RF	28480	00851-8004	2
00851-8005	COIL:RF	28480	00851-8005	1
00851-8006	COIL:RF	28480	00851-8006	1
00851-8008	COIL:RF VARIABLE	28480	00851-8008	2
00851-8009	COIL:RF	28480	00851-8009	1
00851-8010	COIL:RF	28480	00851-8010	1
08551-2083	BUSHING	28480	08551-2083	1
120A-20	BEZEL:CRT.	28480	120A-20	1
120A-83A	LIGHT FILTER:AMBER	28480	120A-83A	1
120A-83G	LIGHT FILTER:GREEN	28480	120A-83G	1
175A-83A	RETAINER:CRT. SHIELD	28480	175A-83A	1

See list of abbreviations in introduction to this section